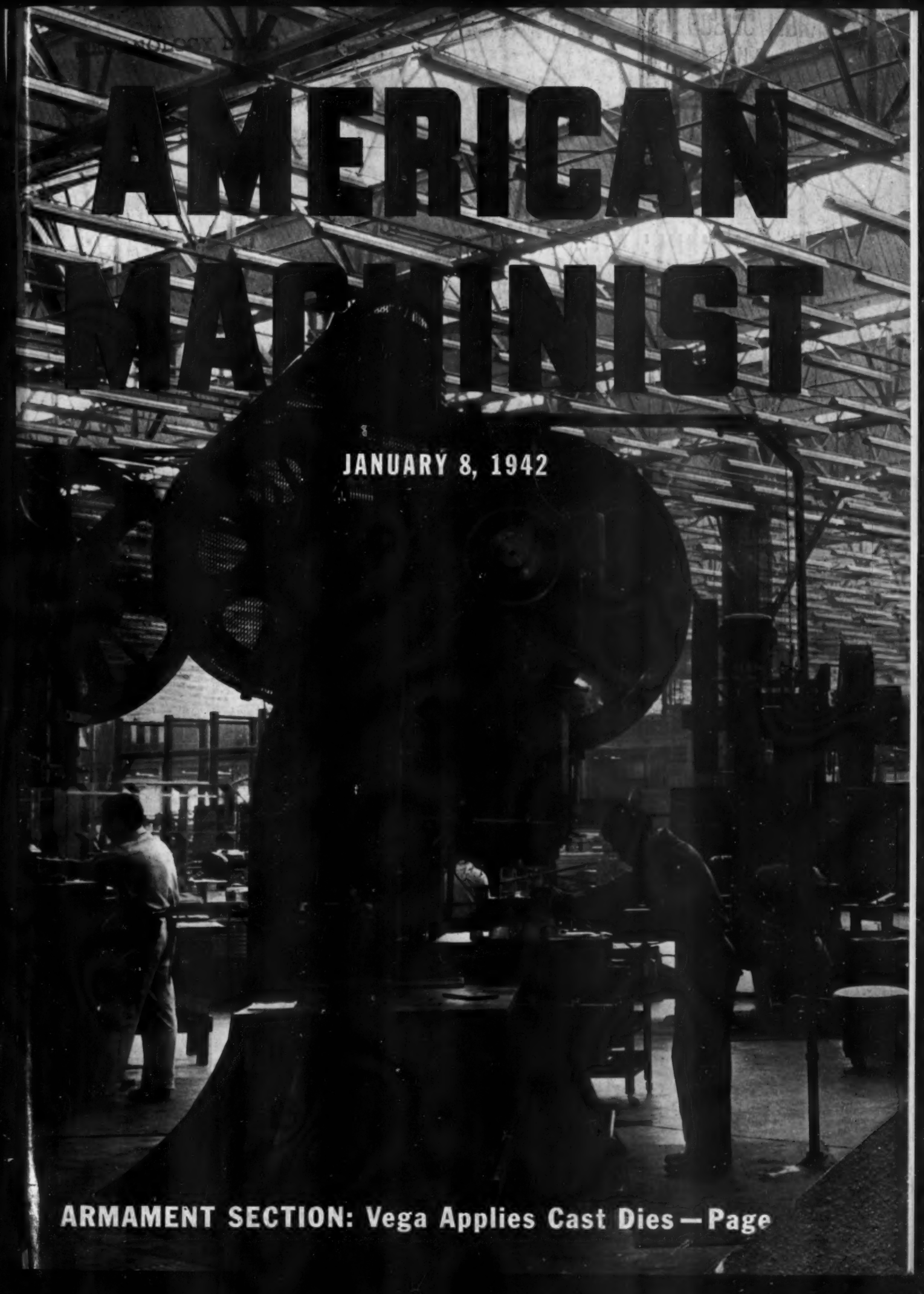
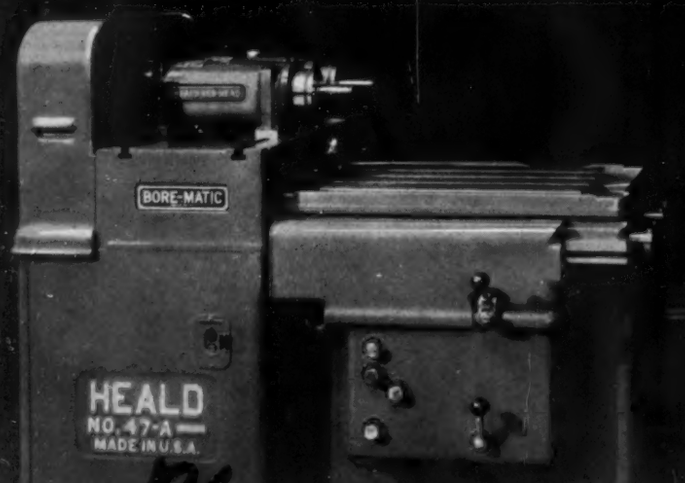


AMERICAN MACHINIST

JANUARY 8, 1942

ARMAMENT SECTION: Vega Applies Cast Dies—Page

Heald
DESIGNED ATTACHMENTS



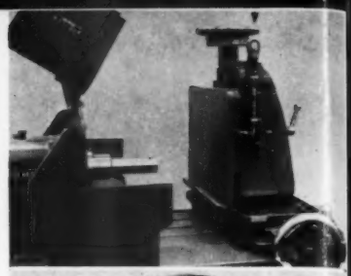
Plus YOUR HEALD Bore-Matic Will Handle *All Kinds* of Precision Finishing Jobs

A combination of Heald Bore-Matic plus Heald designed fixture, tooling, and attachments provides means of handling practically every conceivable precision finishing job . . . not just precision boring but precision turning, facing, chamfering and grooving, too, either separately or in combination as multiple operations. To meet your requirements such a combination might include Bore-Matics equipped with universal fixtures for tool room or small lots . . . hand operated cross-slides for hand indexing between operations . . . hydraulically operated cross-slides for facing and automatic indexing . . . special tooling arrangements for finishing ordinarily difficult-to-machine surfaces . . . or special fixtures that speed up production. . . .

...atever the arrangement recommended, every sugges-
...*But* o...is based on years of practical experience in designing
...engineers and fixtures to exactly match Bore-Matic perform-
...specialization and that means maximum precision on your job.
... you the most ever your problem with you.
...*omplete* fluoresce...
...soundly constructe...
...actical materials ava...

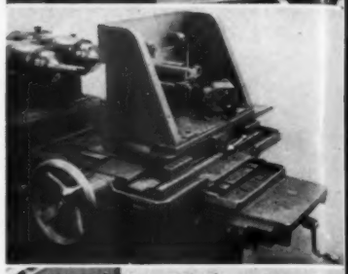
UNIVERSAL BORING FIXTURES

This attachment provides the means of accurately indexing horizontally, vertically and angularly. You can borize multiple surfaces with "jig borer" precision this way.



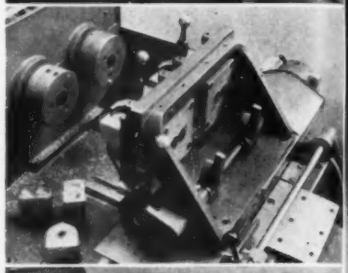
HAND OPERATED CROSS-SLIDES

Such a cross-slide permits indexing between a series of holes as illustrated, or for quick alignment of fixtures on small lot jobs.



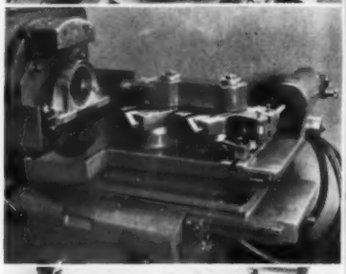
HYDRAULIC CROSS-SLIDES

Hydraulic cross-slides have a variety of useful applications. Their cross movement can be employed for facing operations as shown, for grooving or chamfering, or for indexing.



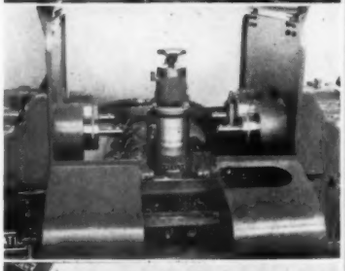
SPHERICAL BORING ATTACHMENTS

These attachments can be used for boring internal spherical surfaces as illustrated, or for turning external spherical surfaces. They provide accurate means of doing a difficult job.



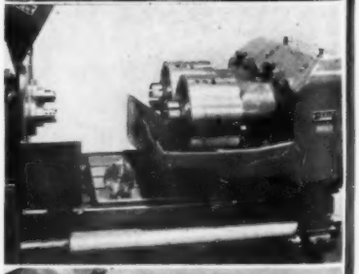
ROTATING TOOL SLIDES

Boring heads on Bore-Matics can be furnished with hydraulically operated tool slides which feed the tool radially while rotating. Very useful for grooving, piston slotting job shown is apt illustration, or for other undercutting work.



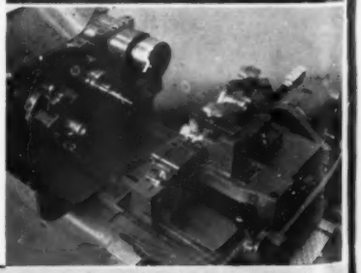
SPECIAL FIXTURES

Heald engineers have designed thousands of fixtures ranging from simple ones to very intricate types. Fixture shown indexes automatically for turning nine teeth on each part.



MULTIPLE OPERATIONS

Fixture and tooling equipment can be furnished on Bore-Matics to form multiple operations in a part. For example the Bore-Matic shown at the right finishes thirteen different surfaces. Operations include boring, facing, turning and grooving.



...ALD MACHINE CO. WORCESTER, MASS. U. S. A.

AMERICAN MACHINIST

January 8, 1942

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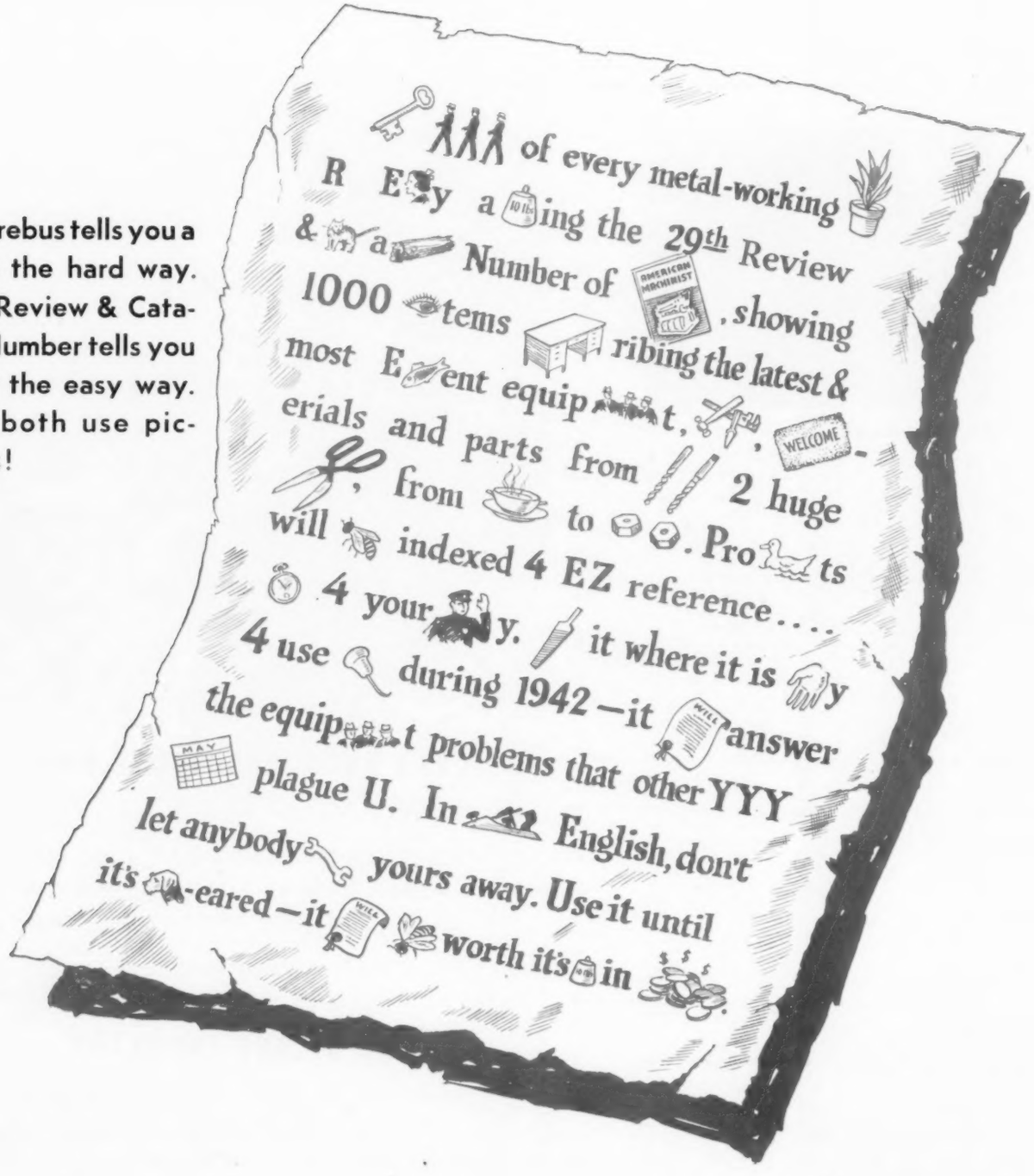
Coming Next Issue...

This rebus tells you a little the hard way. The Review & Catalog Number tells you a lot the easy way. Yet both use pictures!


of every metal-working
R E y a ing the 29th Review
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plague U. In English, don't
let anybody yours away. Use it until
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AMERICAN MACHINIST
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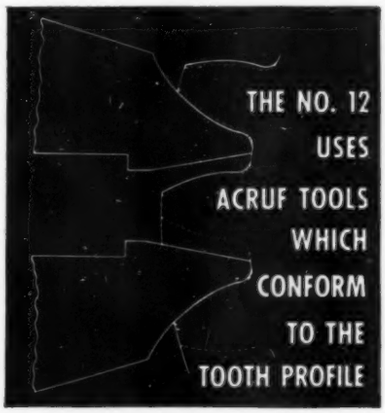
THE 29TH ANNUAL REVIEW & CATALOG NUMBER

AMERICAN MACHINIST · PUBLISHED JAN. 22

GLEASON NO. 12 TWO-TOOL ROUGHER

With the new No. 12 Rougher, fast and extremely close roughing is extended to straight bevel gears and pinions, both in the smaller lot quantities and with front hubs.

The No. 12 operates without generating roll and uses new Acruf tools which leave only a small amount of stock over the entire tooth surface to be removed in finishing. With minor changes in the cycle of the finishing machine, a better tooth finish at savings in finishing time from 35 to 50 per cent is obtained on gears which have been Acrufed on the No. 12.



Send prints together with quantity requirements for complete information on how this new Rougher can reduce your gear cutting costs.

SPECIFICATIONS

Maximum Pitch Diameter	**18″**
Ratios	**1-1 to 10-1**
Coarsest Pitch	**4 D.P.**
Maximum Face Width	**2½″**
Index Range	**5 to 200 teeth**
Floor Space	**63″ x 89″**

GLEASON

GLEASON WORKS

Builders of Bevel Gear Machinery for Over Seventy-five Years

1000 UNIVERSITY AVENUE, ROCHESTER, N. Y., U. S. A.

1942

To country and friends—

Success in the New Year

since 1892

THE LODGE & SHIPLEY MACHINE TOOL CO.

CINCINNATI, OHIO, U.S.A

CINCINNATI

Built to meet 1942 Production Demands

Fast? The complete operating cycle of the CINCINNATI No. 0-8 Plain Automatic Milling Machines is fast because it's fully automatic with 400" per minute power rapid traverse to table and started by the engagement of a single lever. No lost motion.

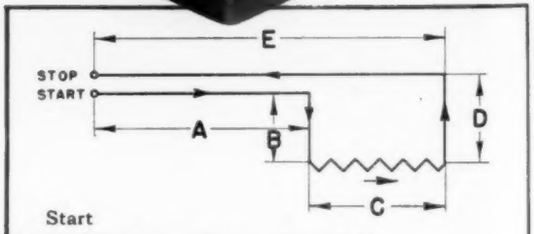
Productive? The No. 0-8 is sturdily constructed with sufficient capacity to easily handle the milling of your small parts.

Flexible? By changing the cycle selector almost any feed cycle may be obtained. When equipped with Rise and Fall Spindle Carrier, the No. 0-8 is especially desirable for operations where it is not possible for the table (work) to traverse directly into the cut.

Accurate? Extremely close tolerances are practical, and you don't have to depend on the operator for accuracy because the machine is completely automatic.

Send for specification catalog M-964 giving complete details on all features and their benefits. You're going to like these No. 0-8 Milling Machines for your small parts work.

It's Fast,



Start

A—Rapid Advance Table—Stop Table.

B—Rapid Advance Spindle Carrier—Down Against Positive Stop.

C—Feed Table—Stop Table.

D—Rapid Return Spindle Carrier to Top of Stroke.

E—Rapid Return Table—Stop.

SAVE *with a Cincinnati!*

Productive, Flexible, Accurate

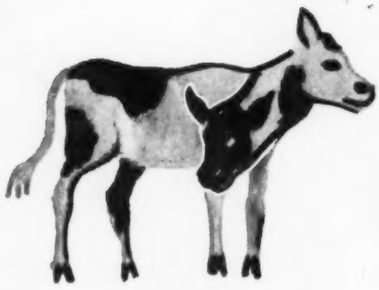
In defense work scores of CINCINNATI No. 0-8 Plain Automatic Milling Machines are engaged in milling countless parts for small arms, airplanes, range finders, cameras, tanks, instruments, fuses and many other essential items. Users are finding that the No. 0-8 *is* Fast, Productive, Flexible, Accurate, and that it is fully capable of meeting 1942 production demands. Send for your copy of specification catalog M-964 today.

THE CINCINNATI MILLING MACHINE CO.

Cincinnati, Ohio U. S. A.

TOOL ROOM AND MANUFACTURING MILLING MACHINES
SURFACE BROACHING MACHINES • CUTTER SHARPENING MACHINES

A two-headed calf may draw idlers at the county fair . . . but . . . practical farmers all prefer to watch the milking contest



Aided by the color and excitement of a county fair, a good promoter can make money with freaks like a two-headed calf.

But practical farmers with an eye on long term business prefer to spend their time getting the facts on milk production.

In the excitement of the present emergency, it may appear that the only answer to many manufacturing problems is to install special equipment for wartime production.

Because special equipment takes time to design and build, and because it can only be scrapped and charged off when peace returns, wise industrial leaders prefer, whenever at all possible, to equip with standard, versatile, modern, long-lived Jones & Lamson machines. Thus they can speed rearmament and be prepared as well against the time when a buyer's market must be faced and sold once more.

It will not obligate you to put your problems up to Jones & Lamson engineers. Inquiries from small plants as well as large receive careful attention here.

JONES & LAMSON MACHINE COMPANY

PROFIT PRODUCING MACHINE TOOLS

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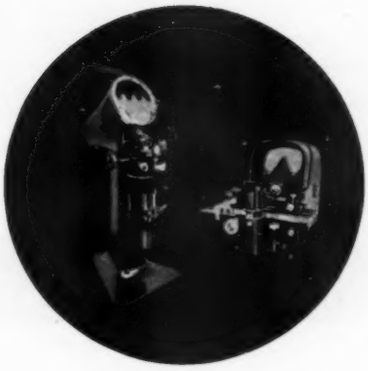
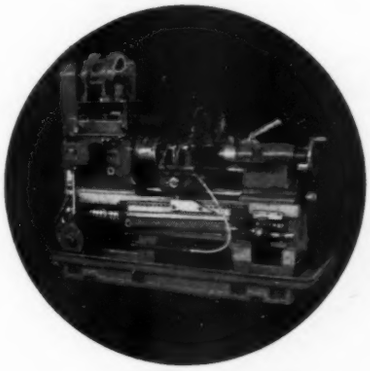
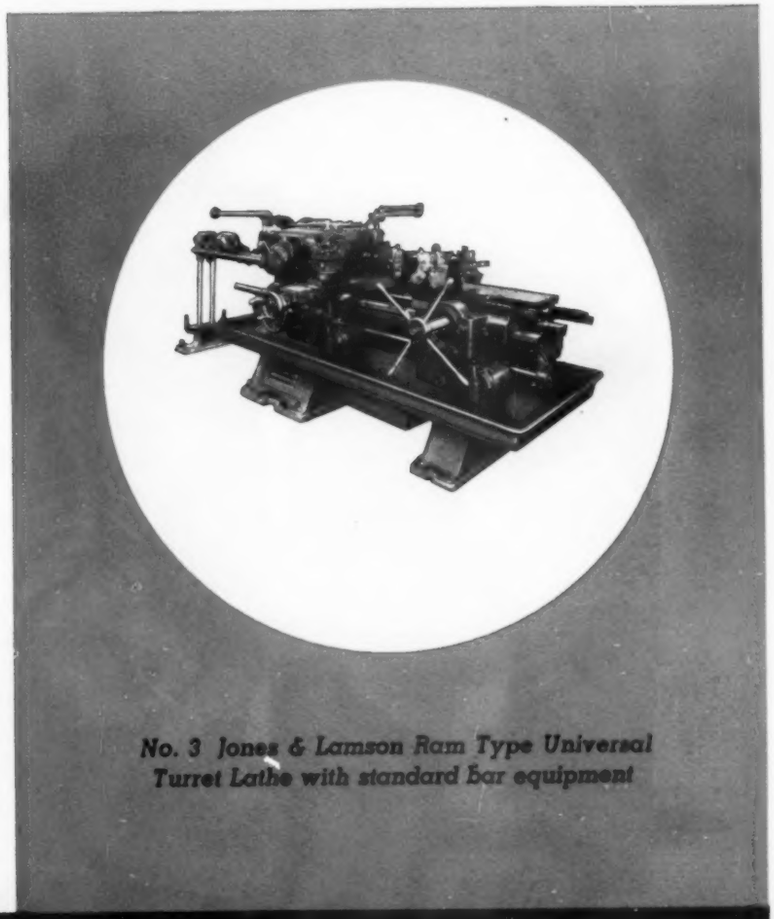
MANUFACTURERS OF: RAM & SADDLE TYPE UNIVERSAL TURRET LATHES . . . FAY AUTOMATIC LATHES . . . AUTOMATIC THREAD GRINDING MACHINES . . . COMPARATORS . . . AUTOMATIC OPENING THREADING DIES AND CHASERS.



Optical Comparators

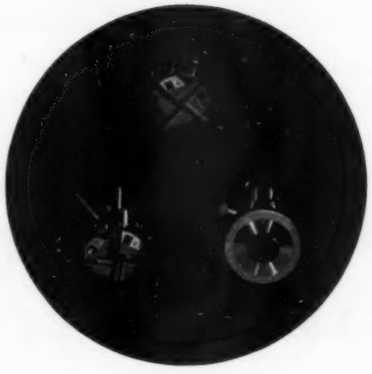


Fay Automatic Lathes



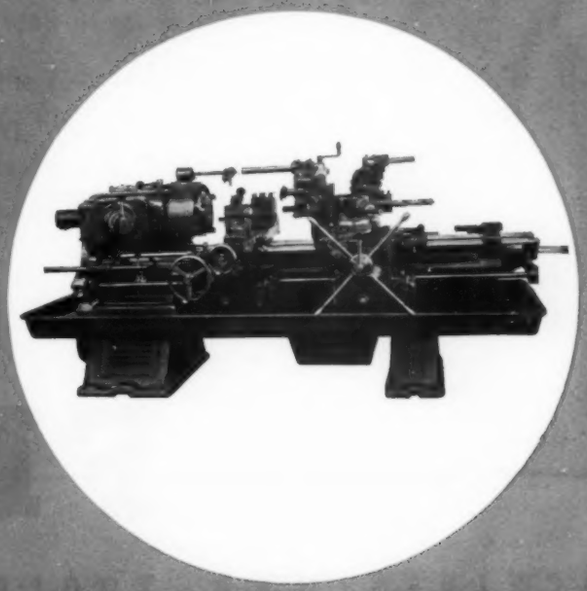
No. 3 Jones & Lamson Ram Type Universal Turret Lathe with standard bar equipment

Automatic Thread Grinders

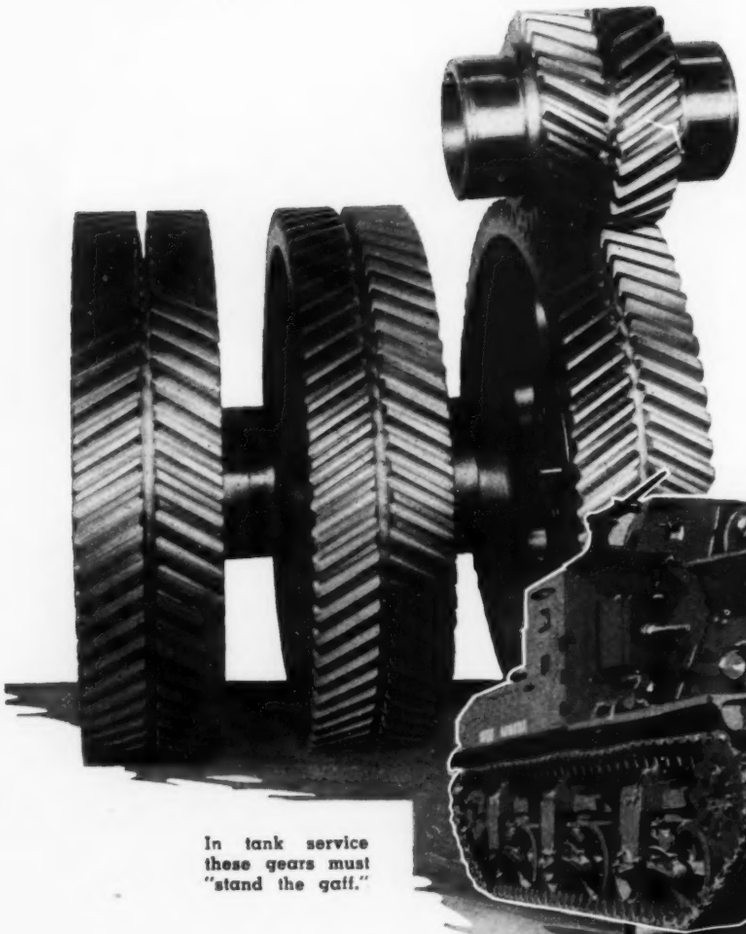


Automatic Opening Die Heads

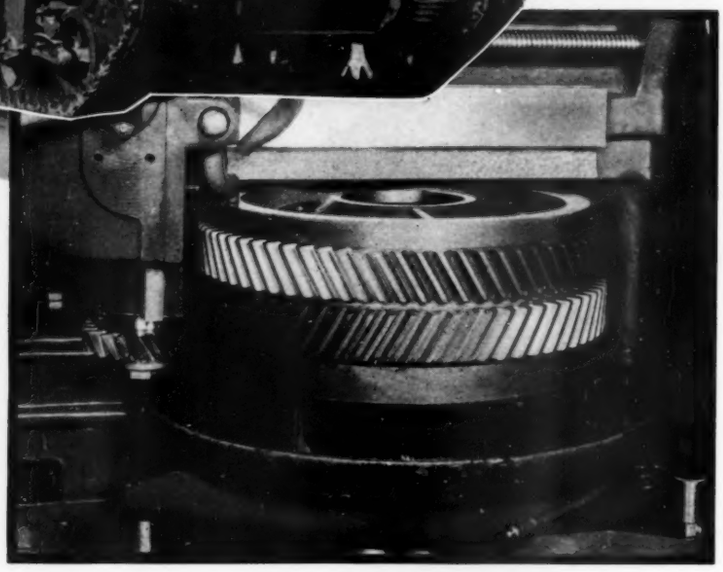
No. 7A Jones & Lamson Saddle Type Universal Turret Lathe with a standard chucking equipment



GEARS



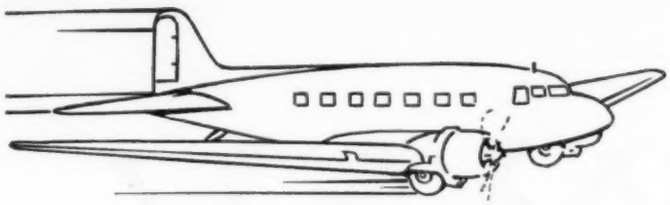
In tank service these gears must "stand the gaff."



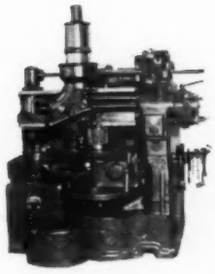
Close-up of the cutting operation using Original Fellows Cutters on the 6-A Type machine.

FELLOWS

MACHINES AND TOOLS FOR GEAR PRODUCTION



for GRUELLING SERVICE



are cut on FELLOWS Gear Shapers for GREATER PRECISION

The same advantages of quick set-up and controlled precision which commend for 6A-Type Fellows Gear Shaper for truck, tractor and airplane gears are now being applied to transmissions for land battleships—the giant tanks.

The herringbone gears illustrated are of the staggered tooth type for a tank-transmission and have a 4 1/4 inch total face width (including the 3/8 inch groove). There are 71 teeth in the gear and 25 in the pinion. The teeth are of 4 pitch, 20° full length with a helix angle of 29° 53'. The blanks are made from alloy steel. Two roughing cuts are taken, using a roughing cutter, and then the gears are finished in one cut, using a finishing cutter.

Production on the Fellows Gear Shaper holds to precision limits, and is at a rate which keeps transmission coming through on or ahead of schedule.

The Gear Shaper is a fundamental part of the Fellows Method, which in all its details is described in our 64-page book of the same title. Write for your free copy. The Fellows Gear Shaper Co., Springfield, Vermont; 116 Fisher Building, Detroit, Michigan; 640 West Town Office Building, Chicago, Illinois.

Method

. . . . FROM BLANK TO FINISHED GEAR

It's all in the

CINCINNATI Hydraulic Universal Grinding Machines are available in 12", 14", 16" and 18" swings and between center distances up to 72".

During the emergency, when time is all important and skilled men so hard to get, CINCINNATI Hydraulic Universal Grinding Machines are especially desirable because much of the skill ordinarily required of the operator has been built into the machine. This means that new men become efficient operators in less time, and more importantly, that your production schedules need not be interrupted because of the scarcity of skilled mechanics.

CINCINNATI Hydraulic Universals are built to handle an exceedingly wide range of toolroom and general manufacturing work. They are so accurate a .0001" limit is practical and you may be sure of dependable, continuous performance over long periods of time because maintenance has been practically eliminated.

Specification catalogs M-486 and M-474 cover complete details on all features and their benefits. We believe it will be to your profitable advantage to send for copies of these informative catalogs today.

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Cincinnati, Ohio U. S. A.

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CENTERLESS LAPPING MACHINES

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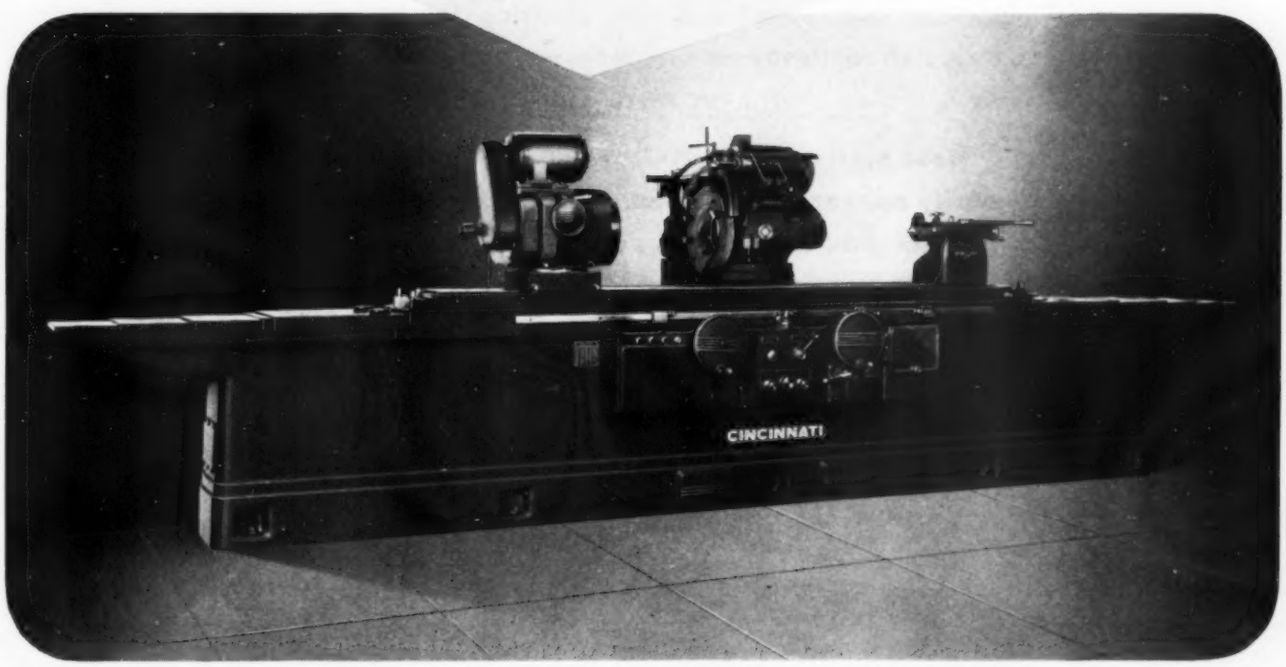
- PRECISION
- VERSATILITY
- FOOLPROOF OPERATION
- LONG LIFE

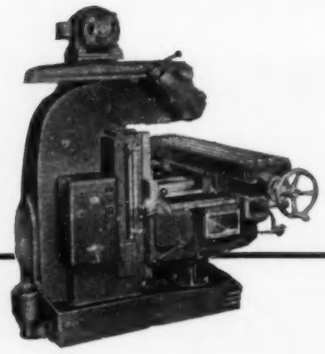
CINCINNATI

SAVE *with a Cincinnati!*



VAN NORMAN RAM TYPE UNIVERSALS

Help to Speed Curtiss-Wright's Milling Work



In the Buffalo plant of the Curtiss-Wright Corporation, No. 26 Ram Type Universals keep toolroom milling output up to top levels, day in and day out. For this uniquely adaptable machine accommodates the work of several single-purpose machines . . . takes any number of successive cuts from horizontal to vertical, without resetting the work on the 50″ x 12″ table. Operator finishes one cut, then quickly swings the cutterhead into position for the next cut, thus avoiding many chances for errors. And what is more, he ends the day far less fatigued and with far more work to his credit.

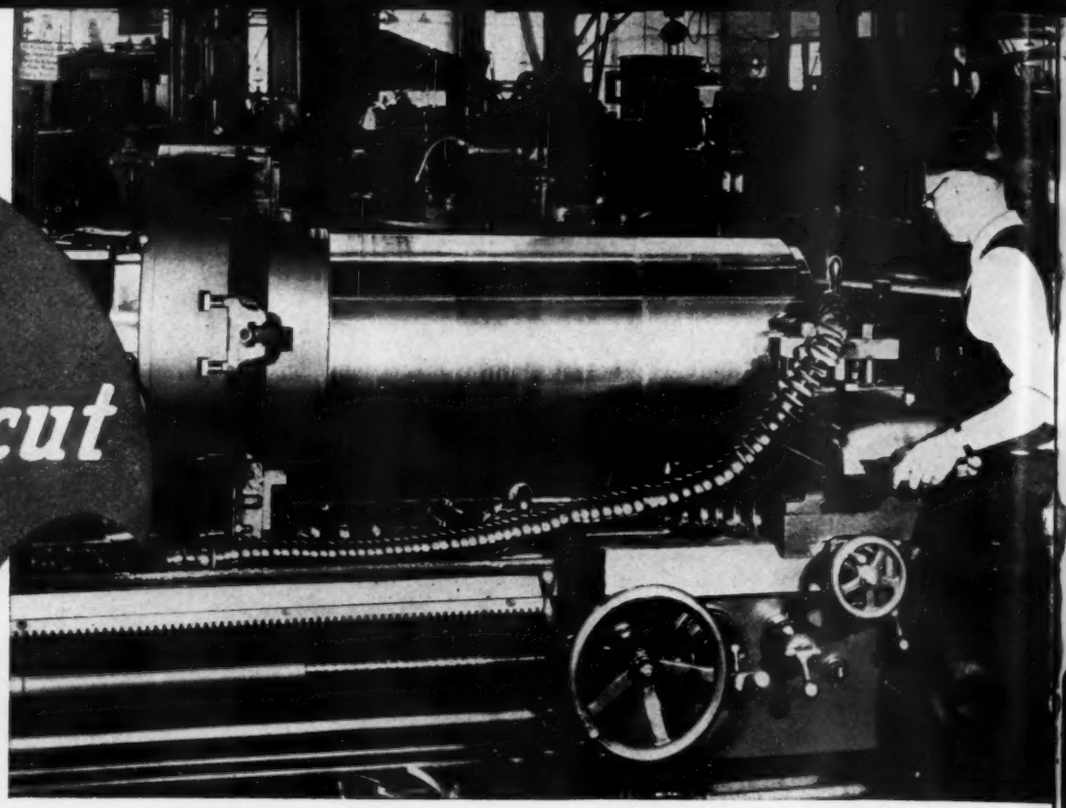
New men can turn out good work right from the start, with this easily operated No. 26 which provides front and rear directional controls of power feeds . . . 6-way rapid traverse of table, knee and saddle . . . extra-large dials for easy, accurate reading. The No. 26 is modern, rigid, fast, built to maintain unvarying accuracy. Write for complete information on this modern milling machine.

VAN NORMAN MACHINE TOOL COMPANY

VAN NORMAN
Milling Machines

SPRINGFIELD, MASS

What a cut AND ON WHAT A LATHE



This "AMERICAN" has everything in power and speed for maximum production and savings

The cut on this husky 42" "AMERICAN" Super Productive Lathe is being taken with a cemented carbide tool on a 24" diameter .60 Carbon steel spindle at a speed of 250 F.P.M.

Even a big job like this comes easy to one of these powerful "AMERICANS"—the lathes with exclusive "American" features—features which insure the maximum in productivity and precision at a minimum expenditure of time and effort.

Your investigation will give you conclusive proof that it pays to turn the "AMERICAN" way.

THE AMERICAN TOOL WORKS CO.
Cincinnati, Ohio

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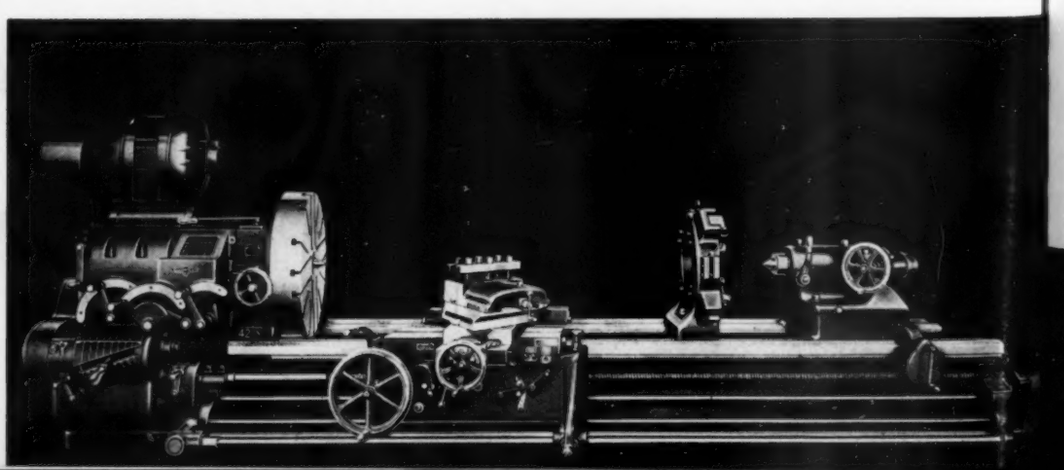
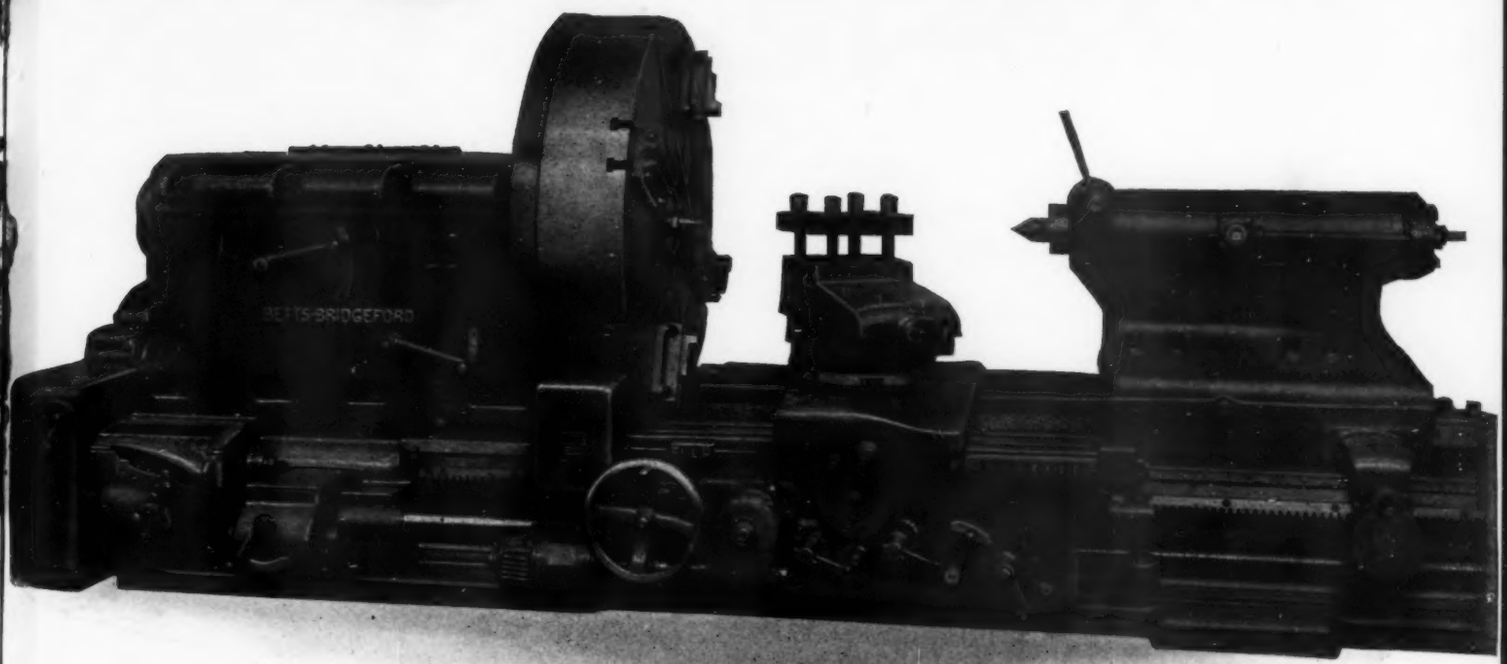
RADIALS
SHAPERS



Big Lathes



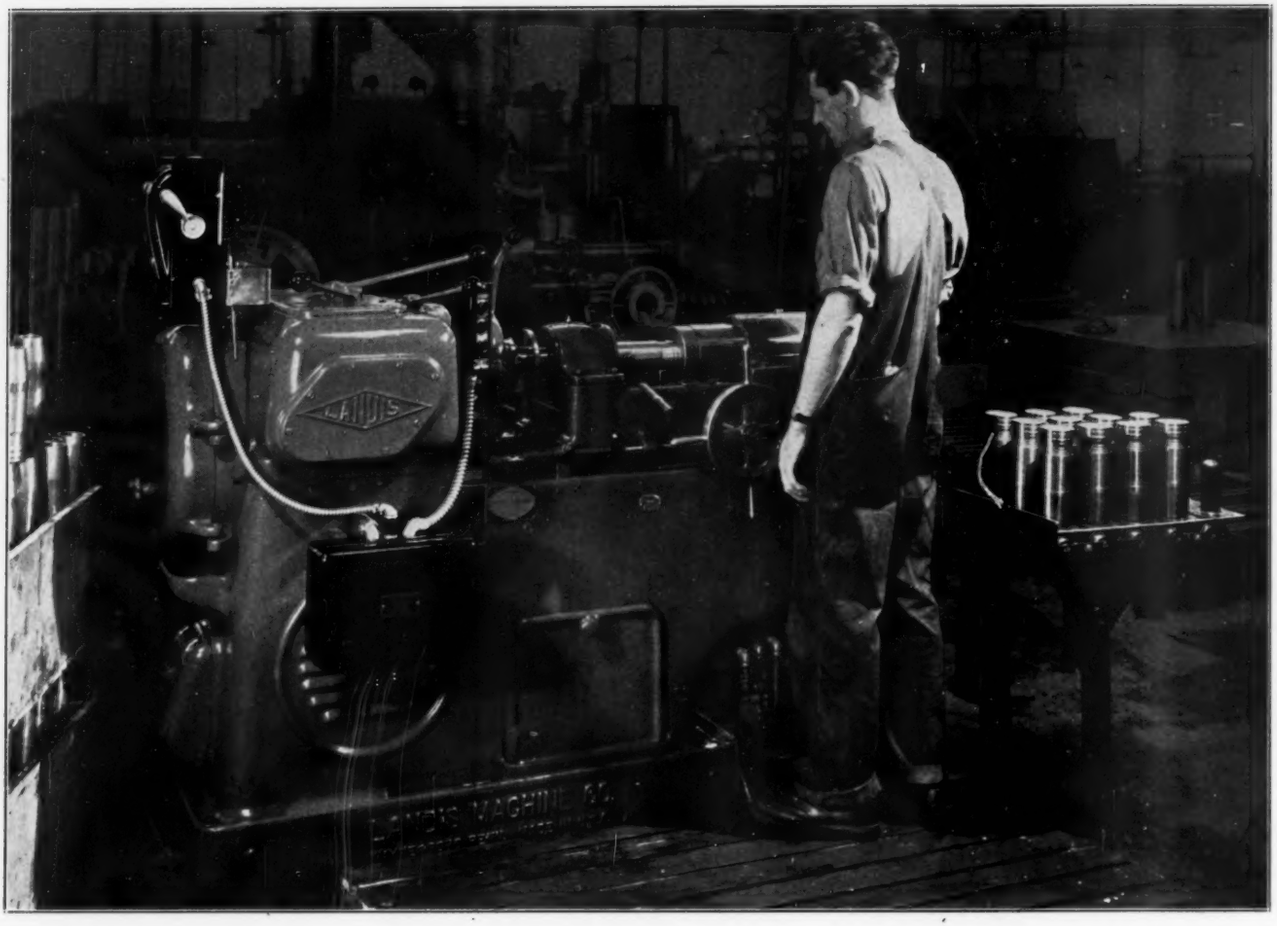
When you see a big Betts-Bridgeford Lathe in action—see it take a husky roughing cut or a smooth finish cut, you will understand why these machines have such an enviable reputation for all around good performance.

Today these Betts-Bridgeford Lathes have the same rugged dependability as in past years and in addition they have every modern improvement for convenience of operation and speed in production.

For your defense jobs where the work is heavy and requirements call for accuracy and speed, it will pay you to look into the help these Lathes can give you.

BETTS • BETTS-BRIDGEFORD • NEWTON • COLBURN • HILLES & JONES • MODERN

CONSOLIDATED
MACHINE TOOL CORPORATION
ROCHESTER NEW YORK



PRODUCTIVE • ACCURATE • ECONOMICAL

—*the 1½ R LANDMACO SHELL TAPPER*

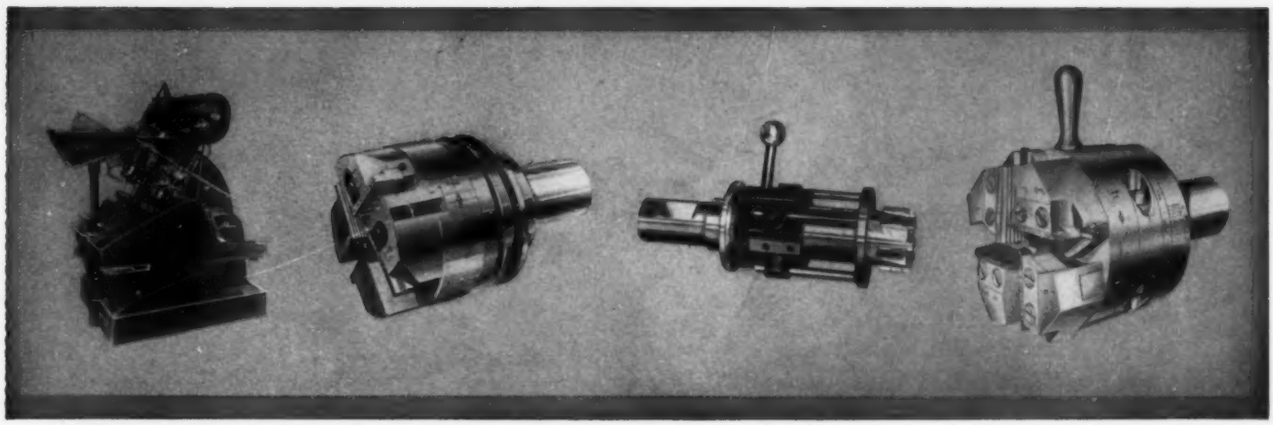
The illustration shows the 1½ R LANDMACO Shell Tapper producing 3" Anti Aircraft Shells

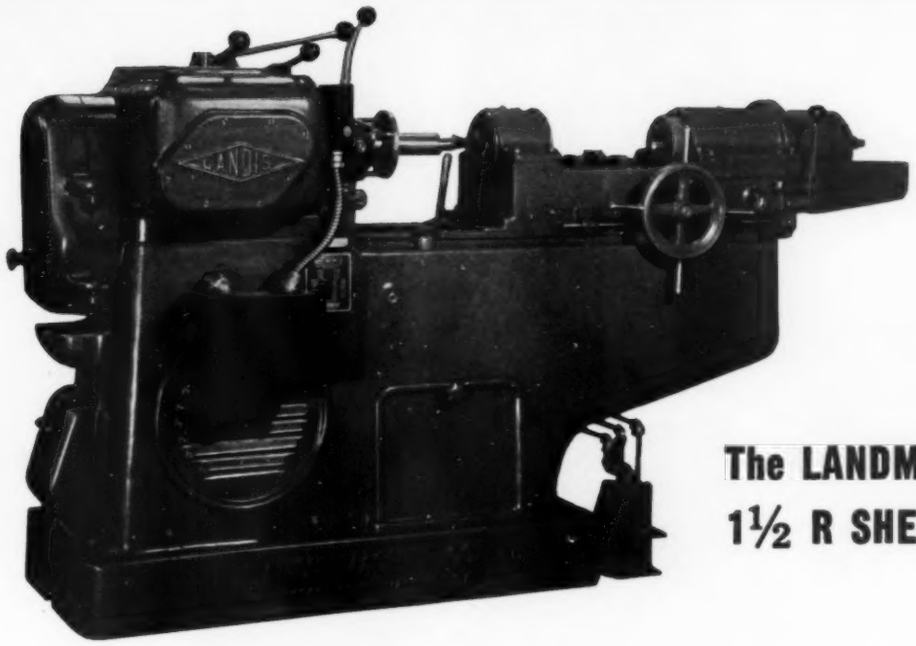
The 1½ R LANDMACO Shell Tapper is a precisely built tool designed especially for tapping shell noses. One machine and one universal fixture will handle all sizes of shells from 75 M/M to 155 M/M inclusive. Production will average from 95 to 116 shells per hour depending upon the size of the shell—and the unusually rigid construction and well engineered design of the machine assures threads within .003" for concentricity with the outside diameter of the work.

For assured Thread Concentricity and greater Productivity in Munitions Threading—Investigate the 1½ LANDMACO Shell Tapper.

LANDIS

MACHINE COMPANY, Waynesboro Pennsylvania



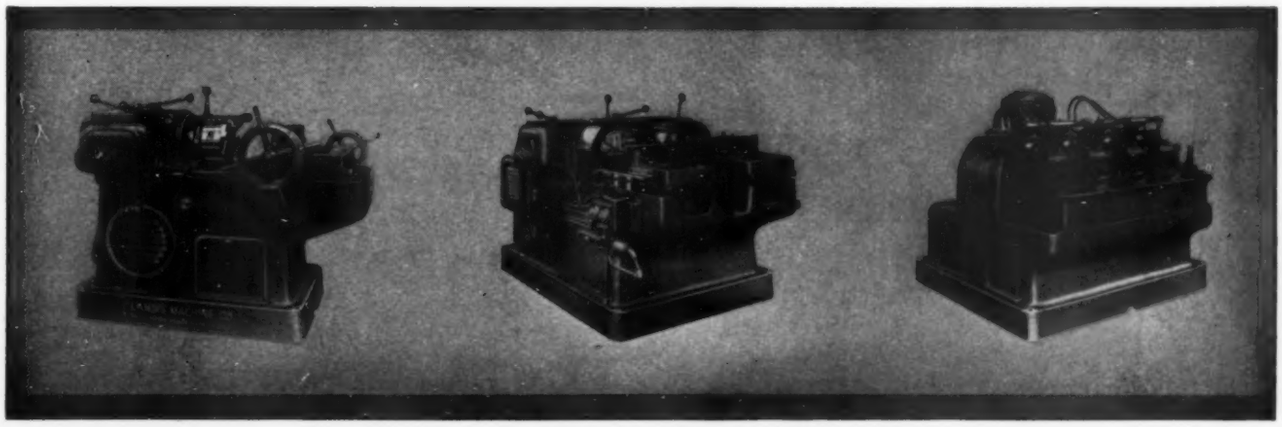


The LANDMACO
1½ R SHELL TAPPER

The LANDIS *Line*

STANDARD THREADING MACHINES
LANDMACO THREADING MACHINES
BOLT FACTORY THREADERS
AUTOMATIC FORMING AND THREADING MACHINES
PIPE THREADING AND CUTTING MACHINES
PIPE AND NIPPLE THREADING MACHINES
ROLLER PIPE CUTTERS
CHASER GRINDERS
ROTARY BOLT THREADING DIE HEADS
STATIONARY PIPE DIE HEADS
LANDMATIC HEADS FOR TURRET LATHES
LANDEX HEADS FOR AUTOMATIC SCREW MACHINES
LANCO HEADS FOR HAND-OPERATED THREADING MACHINES
LANDIS COLLAPSIBLE AND ADJUSTABLE TAPS

– and the LANDIS *Precision* Thread Grinder



Send
Send in the
Bryant
Send in the man from Bryant

Send in the man from Bryant

If any operation, on any product you make, involves internal grinding, it should pay to see the man from Bryant — to tell the man from Bryant all you can about it, to load him down with blueprints, data, specifications and facts in every available form.

Not only has Bryant stepped up production of modern internal grinding equipment (already tripled, and constantly increasing) — but Bryant engineering is also stepping ahead.

Not only does Bryant recognize the duty of American industry to go all-out for defense, but Bryant stands ready today to help far-sighted management to plan low cost production for peace time goods to sell in tomorrow's competitive markets.

So whether your problem is preparedness now or profits tomorrow, let us send in a man from Bryant.

Send in the man from Bryant

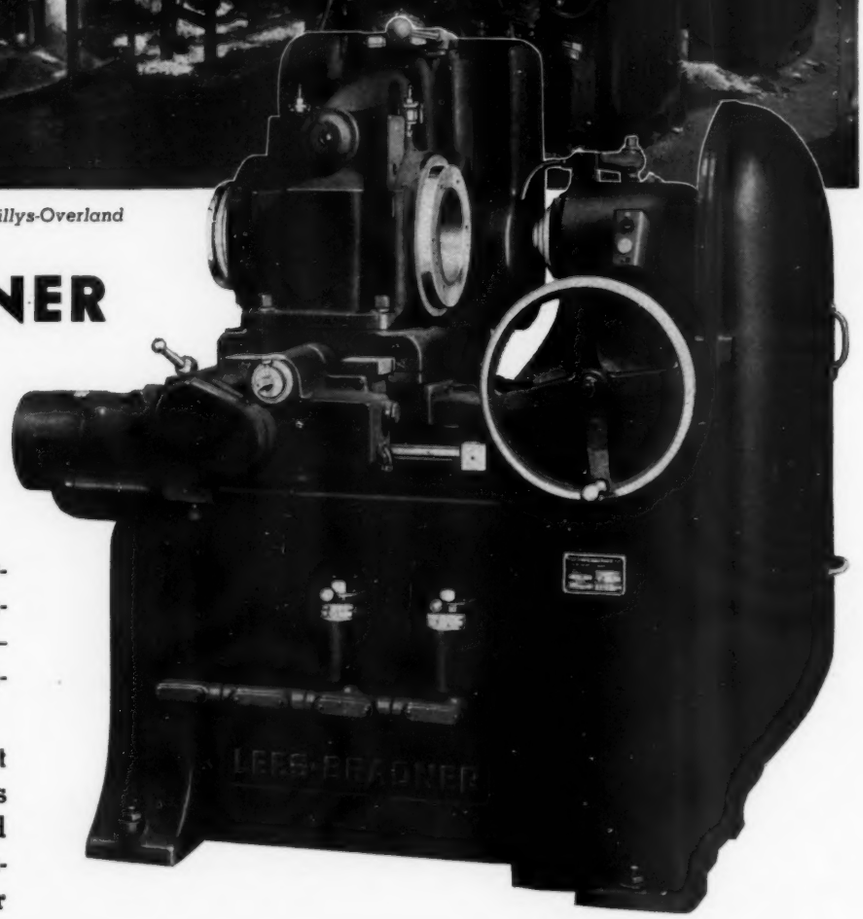
BRYANT CHUCKING GRINDER CO.

SPRINGFIELD, VERMONT, U. S. A.

L-B Automatic Chucking Thread Millers at Willys-Overland Plant, Toledo, Ohio

LEES-BRADNER

MODEL 40
AUTOMATIC CHUCKING THREAD MILLER



The new Lees-Bradner Automatic Chucking Thread Miller meets the urgent demands for mass production of shells with speed—accuracy—and faithful reproduction.

Here is a rugged, compact unit—so simple that it does not require highly skilled labor—so speedy that it establishes a new standard for mass threading.

The LEES-BRADNER Company
CLEVELAND, OHIO, U.S.A.

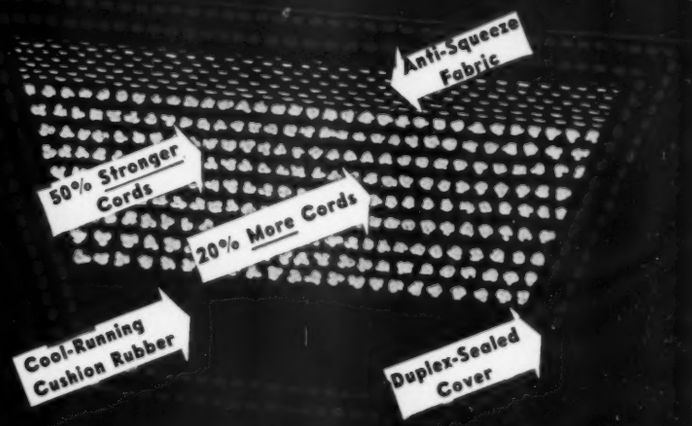
50% STRONGER CORDS
20% MORE CORDS
In Texrope* Super-7 V-belts!

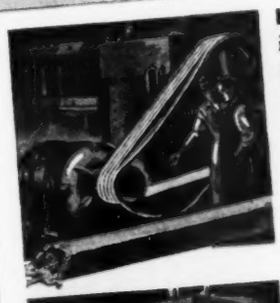
1 50% STRONGER CORDS! Sensational new Flexon process makes cords 50% stronger than even those in former great Texrope belts.

2 20% MORE CORDS! Count them! You get 20% more of these tough, extra pulling power cords in every Texrope Super-7.

3 INCREASED LIFE! Cords float on amazing cool-running cushion rubber that absorbs shock . . . actually increases belt life phenomenally.

4 EXTRA PROTECTION! Exclusive duplex-sealed cover protects pulling cords against dirt, grit, moisture, and other adverse elements.





LOOK OUT FOR DANGER in belts with stiff, unpliable cords! Such belts *look* strong . . . but actually they buckle over sheaves, build up excessive heat that attacks pulling cords. Result: Belt failure far sooner than you expect it.

WARNING SIGN! Sagging, slipping belts mean too much stretch not backed up by balanced cord strength. Motor must be pulled back often to take up slack. Result: When stretch limit is reached belt breaks under tension.

SUPER-7 TEXROPE BELTS are made by amazing Flexon process that *combines* flexibility with low stretch . . . great strength. Cords float on cool-running, shock absorbing cushion rubber. Result: *true* strength . . . *true* pulling power . . . *true* endurance.

MORE production out of *present* equipment—that's the big need today. And that's what you get by changing over your power transmission to new Texrope Super-7 V-belt Drives!

For here's the newest V-belt line on the market—developed and built for modern high-speed production . . . to give you greater belt pulling strength and longer belt life . . . and add urgently needed efficiency to your machines.

You'll like these new belts — with 50% stronger "Flexonized" cords . . . 20% more cords . . . newly developed cool-running rubber cushion section to absorb operating shocks . . . "duplex-sealed" two-ply cover.

And you'll like their true V-shape for greatest groove-grip action . . . their silent, slipless operation.

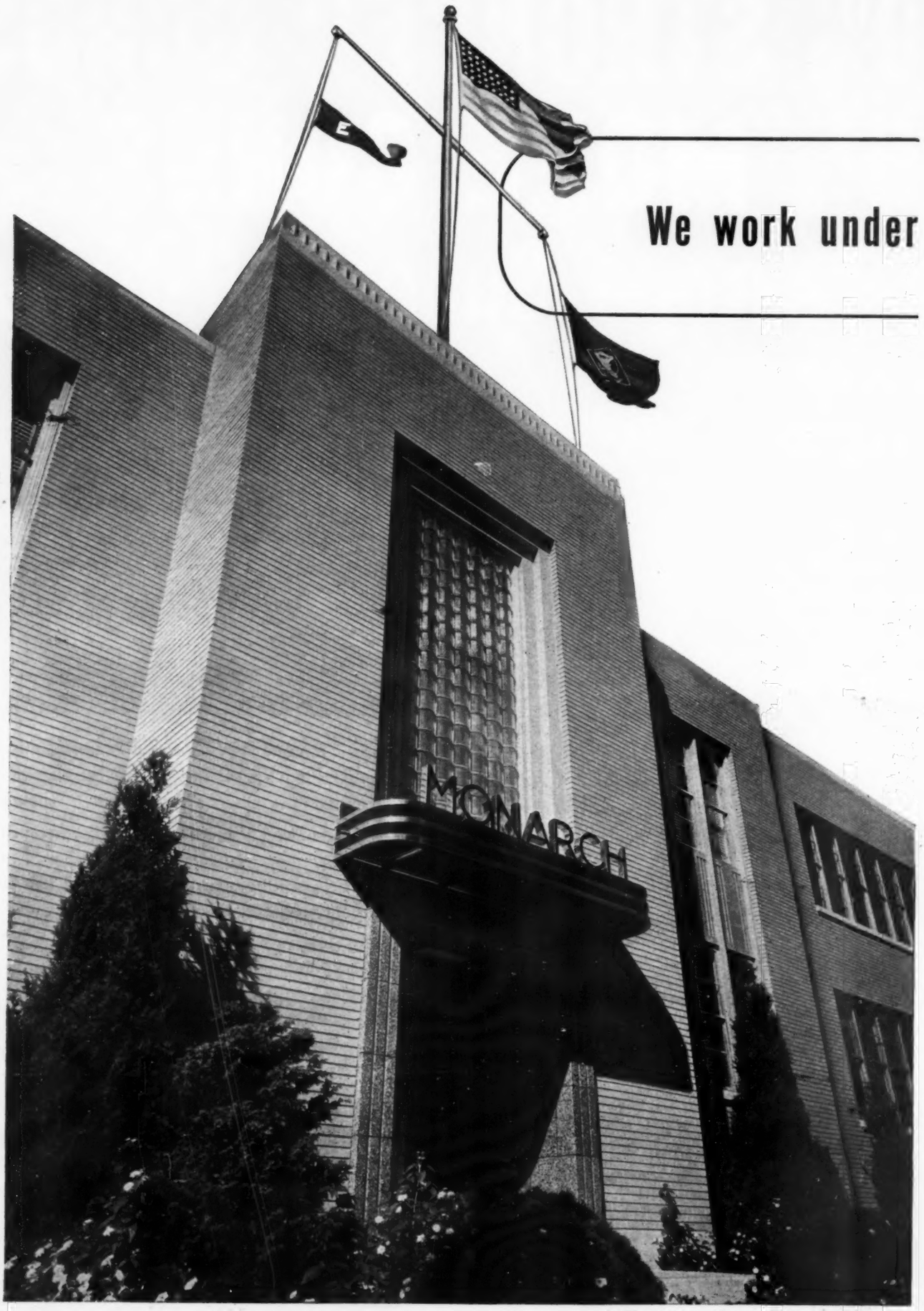
So — do as hundreds of other hard-pressed companies are doing today. Use the new Super-7 V-belts to give increased production capacity to your present equipment.

Call your dealer or the Allis-Chalmers district office near you. Or write direct, asking for Bulletin B6190. A 1470

Available in All Sizes
½ hp to 2000 hp

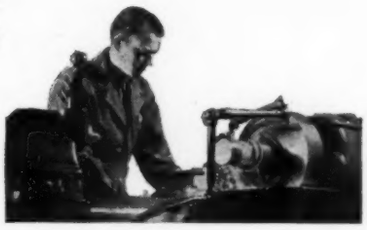
ALLIS-CHALMERS
MILWAUKEE·WISCONSIN

*Trade mark registered U. S. Patent Office. Texrope Super-7 Belts are the result of the cooperative research and design genius of *two* great companies — Allis-Chalmers and B. F. Goodrich — and are sold exclusively by Allis-Chalmers.



We work under

these flags with a new sense of duty



WHEN we were awarded the flag of the U. S. Navy Bureau of Ordnance and the Navy "E" Pennant, we at Monarch were proud and thrilled with the honor.

But, as we work with these flags flying above us, we realize that with this recognition come a new obligation, a new duty.

That is—to continue to merit the confidence placed in us.

During 1941, we doubled our production of lathes over 1940. This was five times greater than in 1939, ten times that of 1929. We are proud of these accomplishments, but not satisfied with them.

We realize that to win this war, we at Monarch must more than ever keep everlastingly at it, working with other industries and plants to supply the tools and equipment needed by our Navy and Army and our allies.

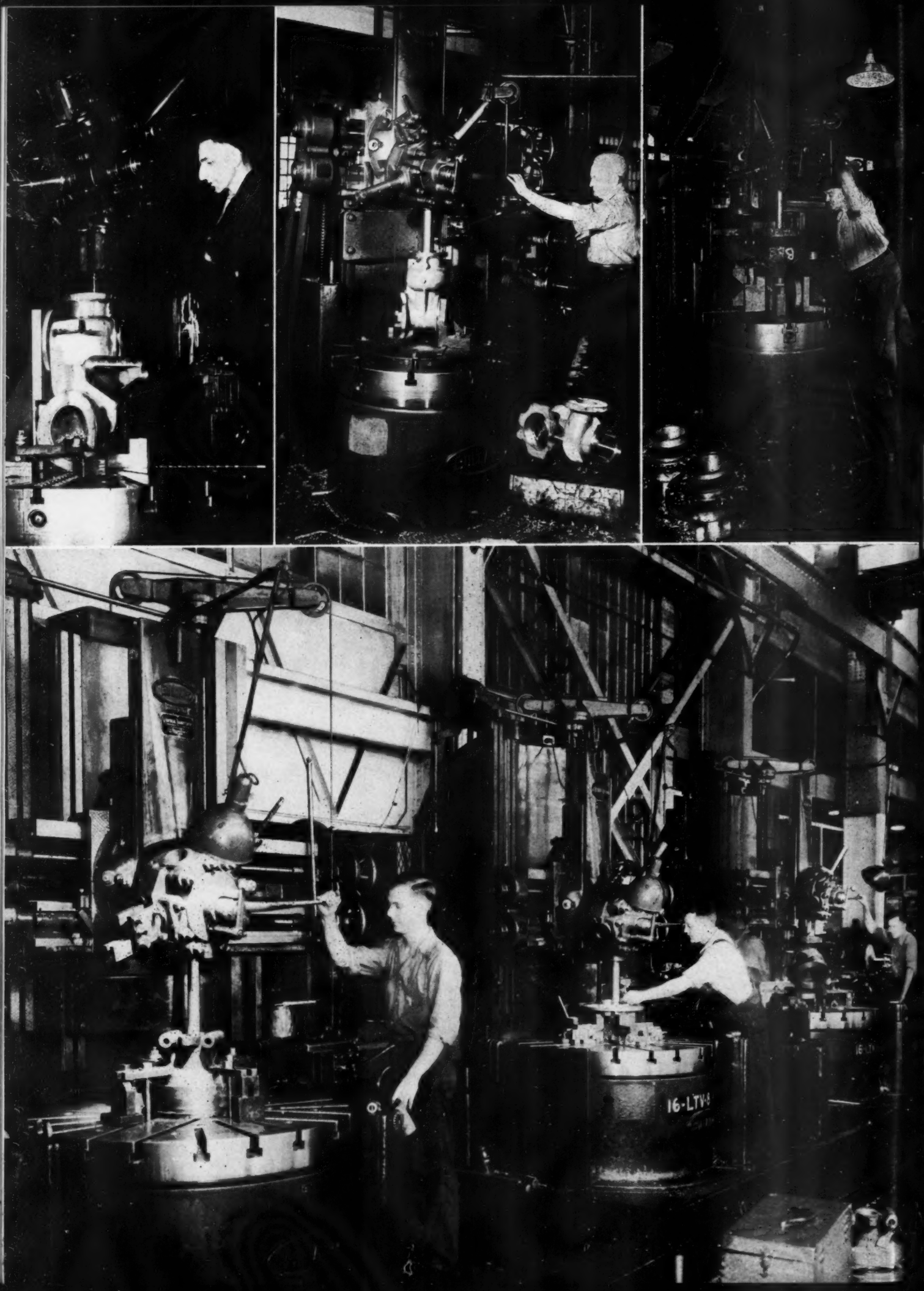
Further — we realize that we must continue to earn our "EXCELLENT" rating not alone by the *quantity* of our production, but also by maintaining Monarch's high standards of *quality*, so essential to satisfactory performance under extreme emergency demands.

To the fulfillment of these obligations we pledge our personnel and our plant facilities "for the duration."

THE MONARCH MACHINE TOOL COMPANY · · · SIDNEY · OHIO

MONARCH LATHES

COVER THE TURNING FIELD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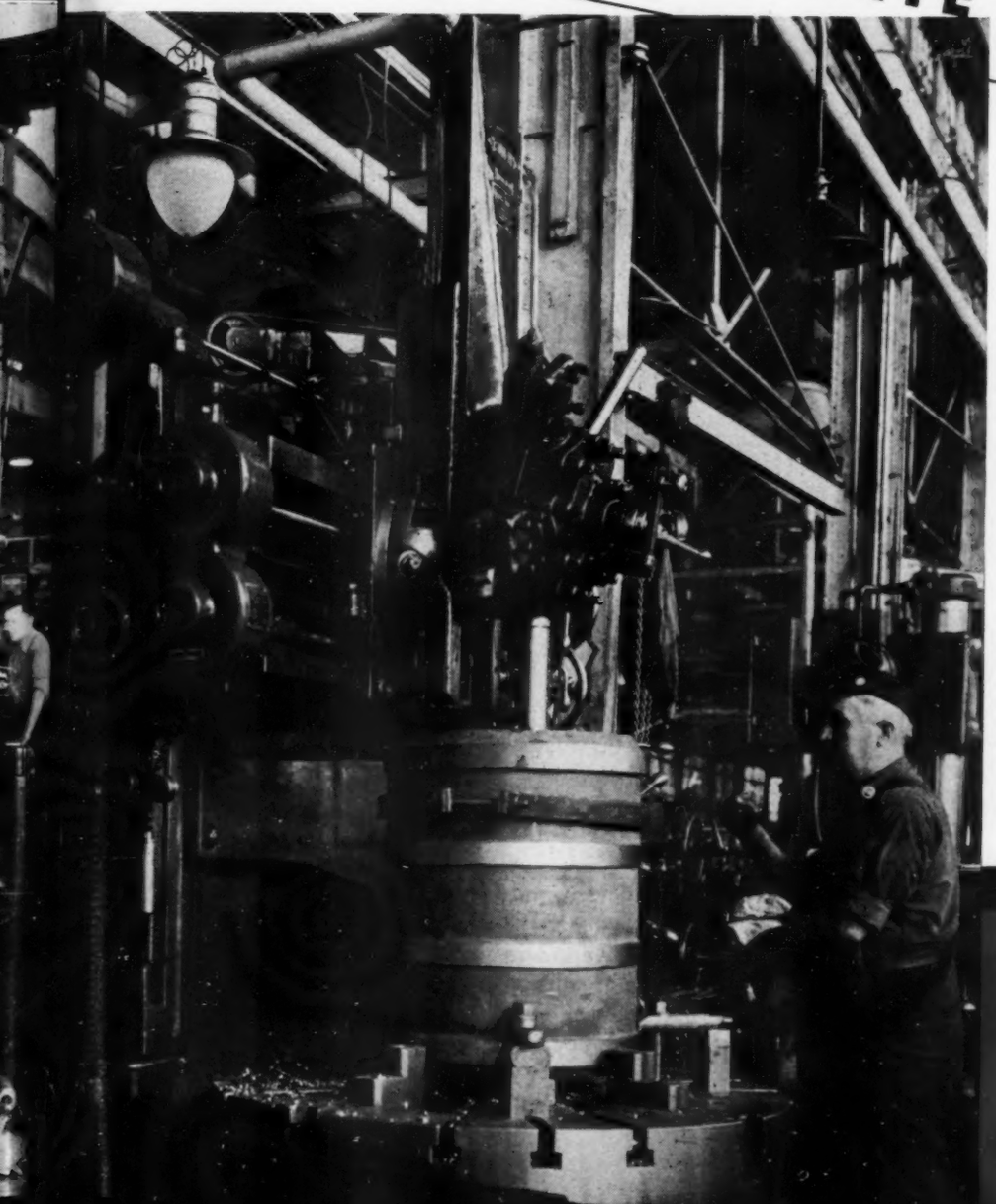
BULLARD

a name universally recognized for fast, economical and **ACCURATE** *production*



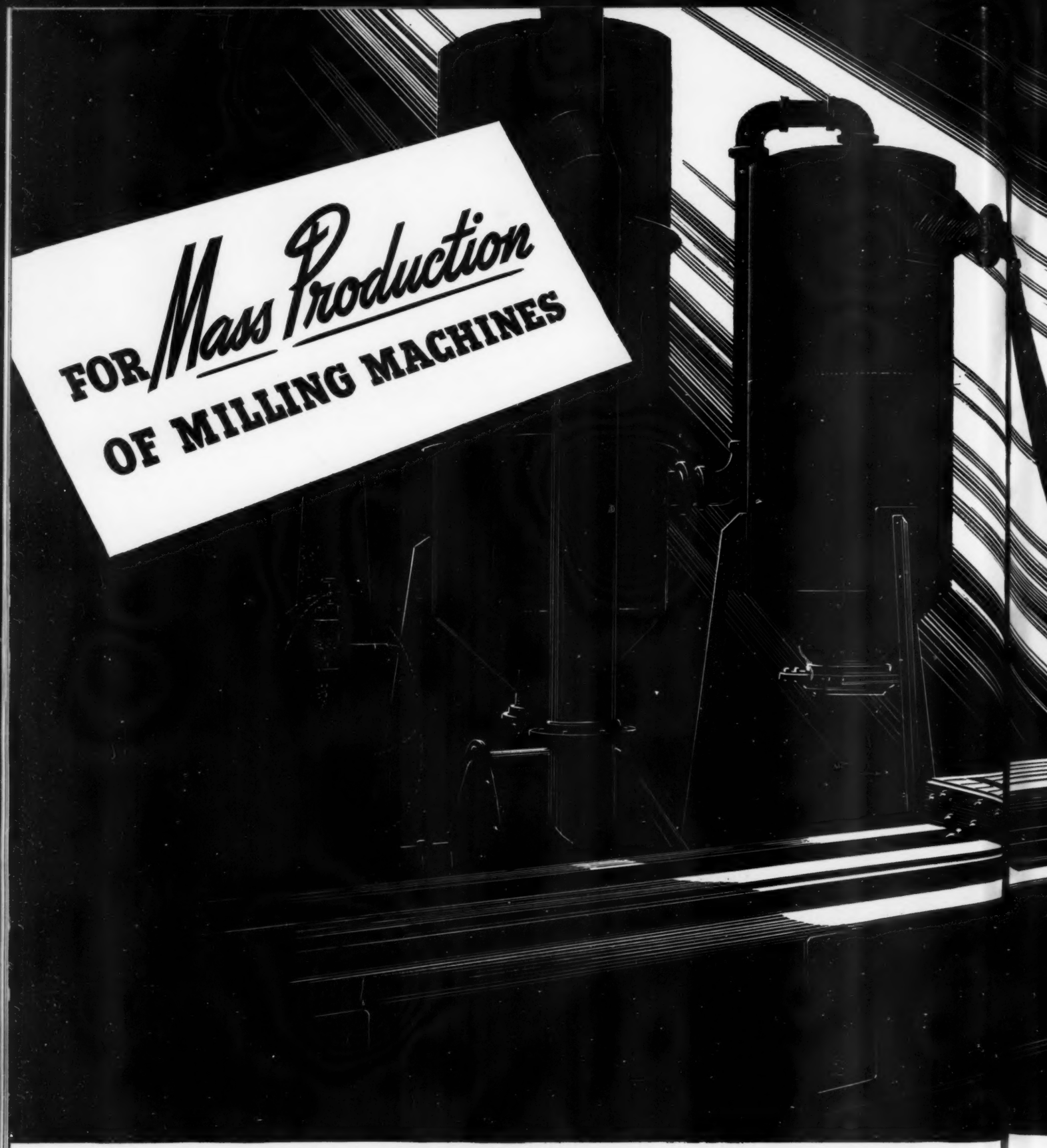
Today's machining operations on countless steam valves, torpedo tube valves, and similar high pressure fittings and equipment used in Naval construction require the use of fully dependable Machine Tools capable of performing within extremely close tolerances—of permitting the use of most modern toolings and fast-cutting alloys—of producing a fine degree of workmanship and finish at high output rates. Bullard Vertical Turret Lathes are universally accepted for such assignments. In fact, Yards and Plants in the United States engaged in Naval production employ Bullard Vertical Turret Lathes to full advantage—and reap benefits measurable in high standards of accuracy, ease of operation and outstanding economies. Bullard engineering data is available to production executives engaged in Defense Work.

The photographs on these pages show Bullard Vertical Turret Lathes in operation on Naval Fittings and parts in the shops of the Philadelphia Navy Yard, Bath Iron Works, Electric Boat Company, and other nationally known plants.

THE BULLARD COMPANY

•

BRIDGEPORT CONNECTICUT



Specialized machines—modern marvels of engineering — are a basic part of the carefully planned and coordinated production facilities, functioning a full 168 hours per week, which make it possible to manufacture Milwaukee Milling Machines in volume to the highest standards of machine-tool precision and quality.

This 15 ton, seven-spindle production unit was designed for machining T Slots in milling machine tables. It eliminates five independent cuts and increases production by more than 550% over ordinary methods. But what is most important — it insures a higher degree of accuracy than was previously obtainable.

Milwaukee MILLING

The full production capacity of our plants, the largest in the world devoted exclusively to the manufacture of milling machines . . . is dedicated to national security.

KEARNEY & TRECKER CORPORATION
MILWAUKEE, WISCONSIN, U. S. A.

KEARNEY & TRECKER
CORPORATION
Milwaukee
MILLING MACHINES

One of a series of advertisements describing specialized machines — originated, designed and built by Kearney & Trecker Corp. to assure the quality of Milwaukee Milling Machines under mass production.

M A C H I N E S . . . .

Twist Drills — Milling Cutters — Reamers — Hobs — Slitting Saws—End Mills—Taps—Dies—Screw Plates —Profile Cutters—

THE TOOLS YOU BUY AGAIN

Try them on the basis of ASSURED *better performance . . .*

Shop after shop has come to recognize the ruggedness, accuracy and fast cutting action of UNION TOOLS after proving them out on difficult jobs.

There is sound reason for the better performance of these cost cutting tools. One of these reasons is the *experience behind them*—an experience that involves years of research, as well as outstanding technical, metallurgical and manufacturing facilities second to none in the field of small tool production.

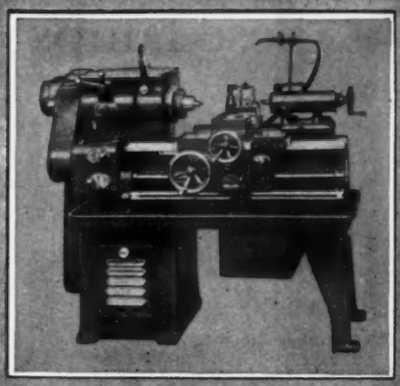
Because Union has the means for producing tools of the finest quality and concentrates every resource on achieving highest performance standards on all tools bearing the name "UNION", users of UNION tools can always be certain of efficient, economical service.

UNION TWIST DRILL CO.
Athol, Mass.

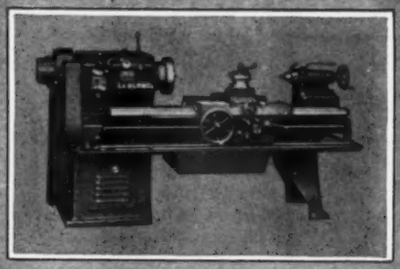
STORES New York Store: 61 Reade St.; Los Angeles Store: 524 East Fourth St.; Chicago Store: 11 So. Clinton St.; Seattle Store: 568 First Ave., So.; San Francisco Store: 121 Second St.; Detroit Store: 6540 Antoine St.

MANUFACTURING DIVISIONS
S. W. Card Mfg. Co., Div.; Mansfield, Mass.
Butterfield Division, Derby Line, Vt., and Rock Island, Quebec
Representatives throughout the world

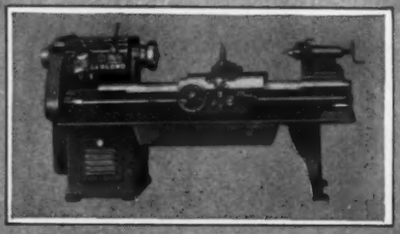
UNION



LeBlond 13"
Rapid Production Lathe



LeBlond 17"
Rapid Production Lathe



LeBlond 20"
Rapid Production Lathe

LeBLOND LATHES
are getting FASTER Everyday, too

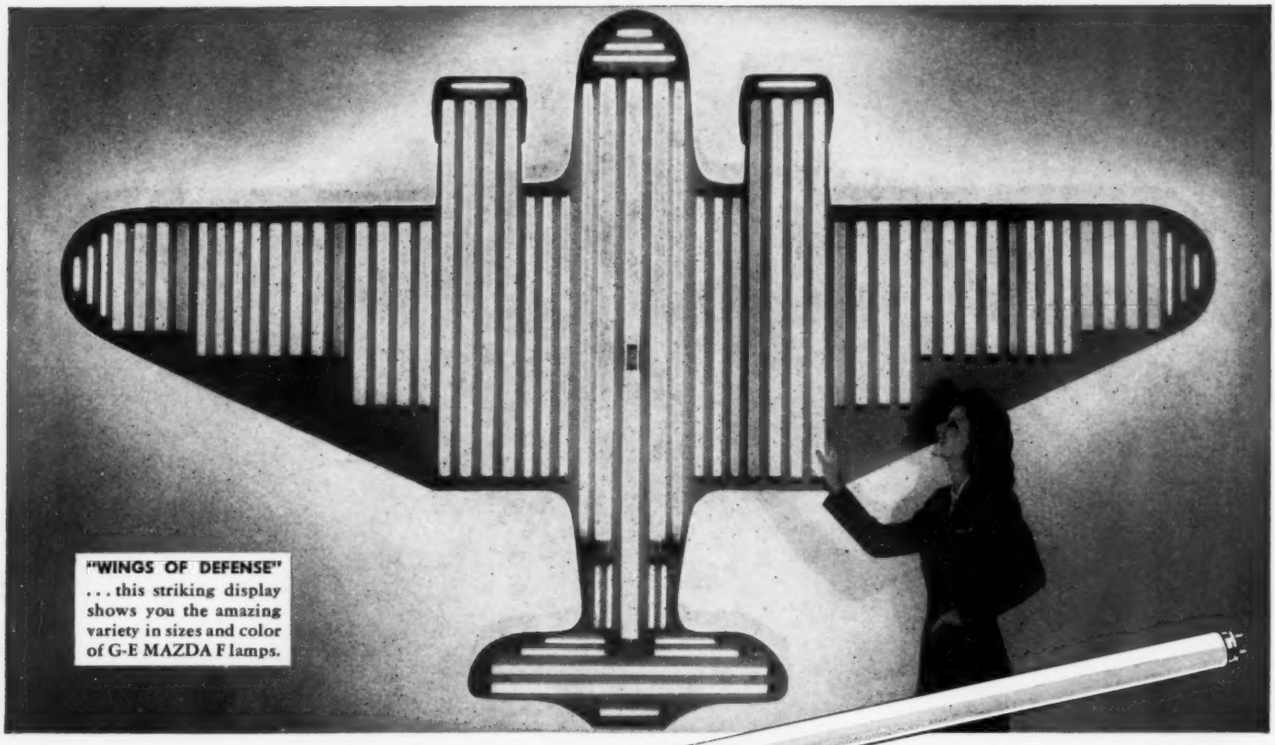
In the race against time, LeBlond lathes come out the winner. Take the LeBlond Rapid Production Lathes (13", 17", and 20"), for example. These speedy lathes have won recognition all over the country as production doublers par excellence. And yet, with all their speed, there is no sacrifice of accuracy. For the Rapid Production Lathes, like all LeBlond machine tools, are rigidly constructed to turn work with infinite precision at gruelling speeds . . . fast, accurate production year after year.

THE R. K. LeBLOND MACHINE TOOL CO.

Cincinnati, Ohio

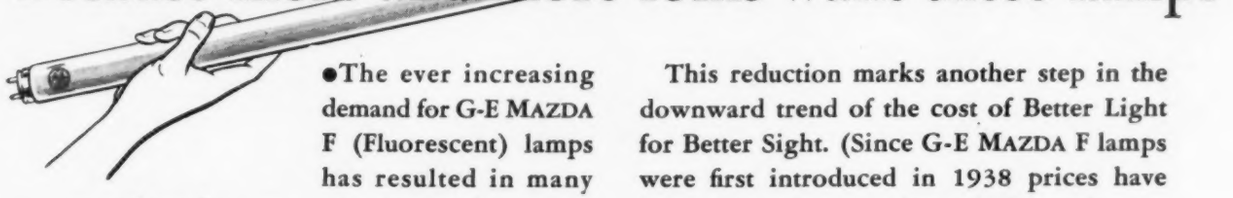
Chicago Office
20 N. Wacker Dr.
STA 5561

New York Office
103 Lafayette St.
Canal 6-5281



"WINGS OF DEFENSE" . . . this striking display shows you the amazing variety in sizes and color of G-E MAZDA F lamps.

Because more and more folks want these lamps



●The ever increasing demand for G-E MAZDA F (Fluorescent) lamps has resulted in many manufacturing economies in our fluorescent factories. In line with long established General Electric policy, these savings are passed along to our customers through the reduced prices on G-E MAZDA F lamps announced below, effective January 1, 1942.

This reduction marks another step in the downward trend of the cost of Better Light for Better Sight. (Since G-E MAZDA F lamps were first introduced in 1938 prices have been reduced as much as 60%). It is particularly significant now, since so many of these lamps are being used to supply cool, efficient "indoor daylight" for defense industries . . . to speed production, cut down waste and protect the eyesight of defense workers.

Effective January 1, 1942

NEW LOW PRICES ON G-E MAZDA F LAMPS

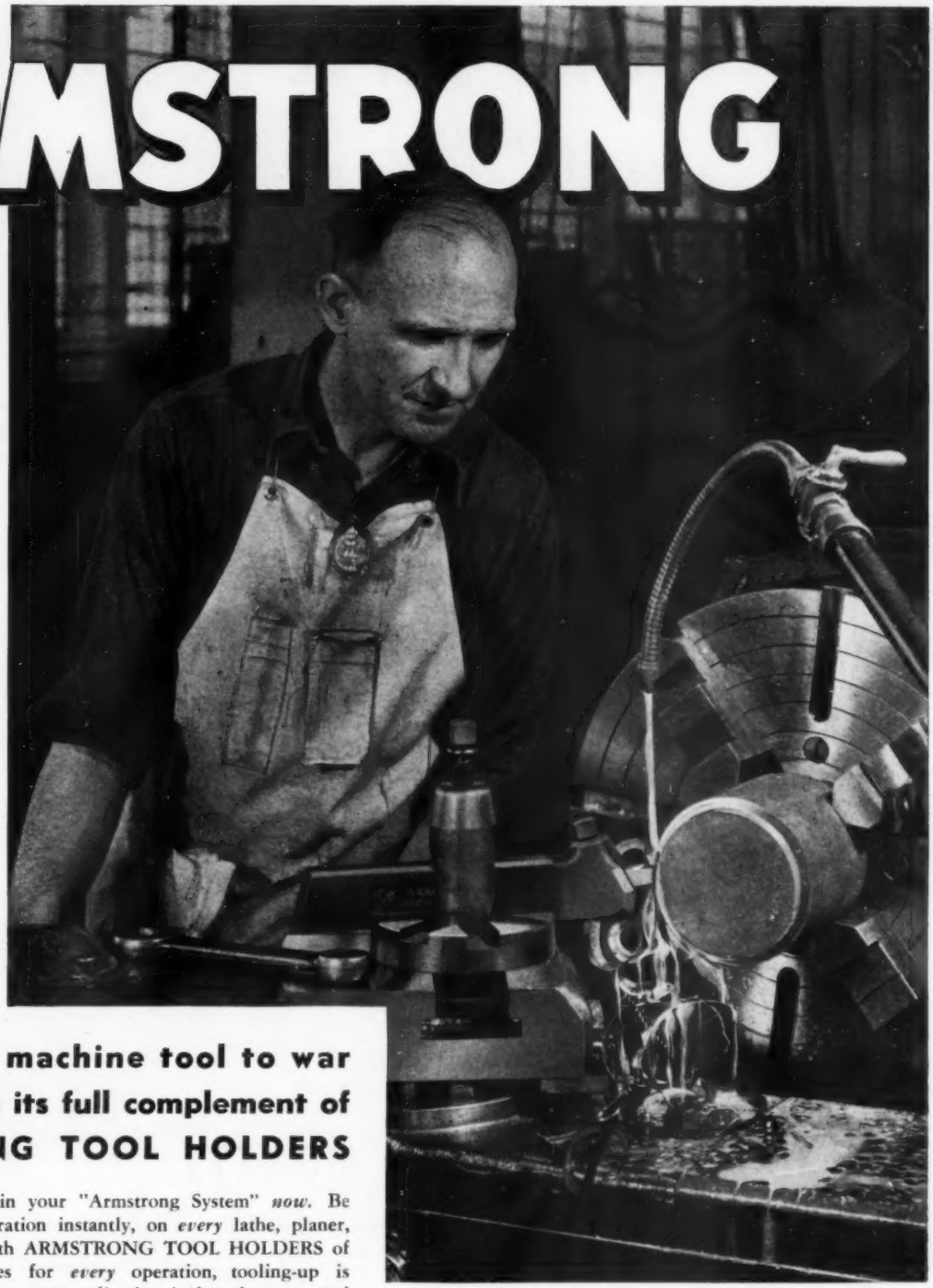
14-watt T-12	was 90c	NOW	80c
15-watt T-8	was 75c	NOW	65c
15-watt T-12	was 95c	NOW	80c
20-watt T-12	was 95c	NOW	80c
30-watt T-8	was 95c	NOW	80c
40-watt T-12	was $1.35	NOW	$1.15
100-watt T-17	was $3.00	NOW	$2.60

Above prices refer to daylight and 3500° white.
Prices also reduced on soft white and colored G-E MAZDA F lamps.

G-E MAZDA LAMPS

GENERAL ELECTRIC

ARMSTRONG



Bring every machine tool to war strength with its full complement of ARMSTRONG TOOL HOLDERS

Fill up the vacancies in your "Armstrong System" *now.* Be ready to start *any* operation instantly, on *every* lathe, planer, slotter and shaper. With ARMSTRONG TOOL HOLDERS of correct sizes and types for *every* operation, tooling-up is reduced to selecting the cutter, adjusting it for clearance and tightening a set screw. Operation is safe and efficient at full capacity (above standard cutting speeds) and *high speed steel consumption is reduced* 90% in a ratio to work done. This is no time for machine tools to stand idle waiting for a tool dresser to forge harden and grind tools; is no time to hold down output by "getting by" with makeshift or misapplied cutting tools.

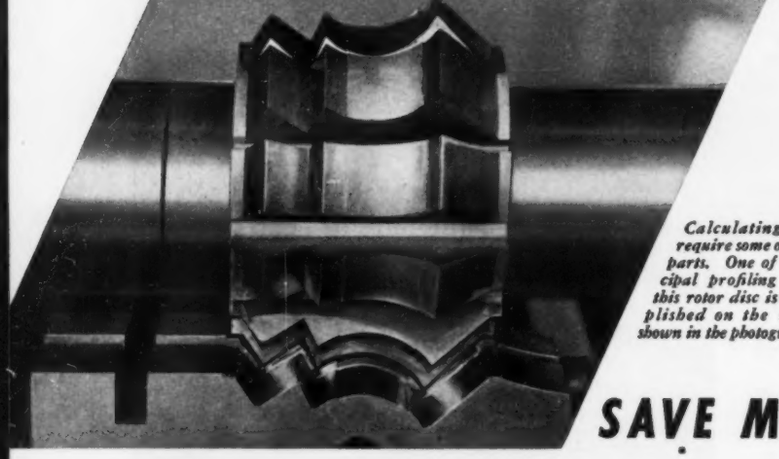
For continuous uninterrupted, all-out production, for greater speed efficiency and accuracy, and, *to make each ounce of high speed steel* go 10 times as far, use the right ARMSTRONG TOOL HOLDER for each operation.

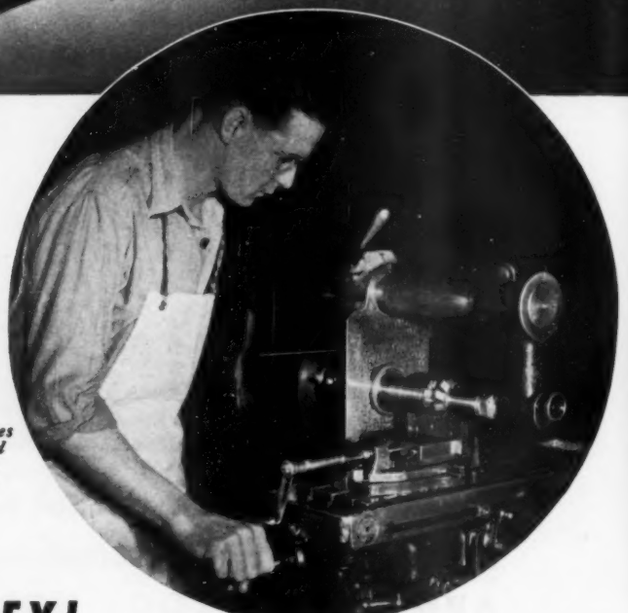
ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
315 N. FRANCISCO AVE. CHICAGO, U. S. A.
Eastern Warehouse & Sales Office:
199 Lafayette Street, New York

ARMSTRONG TOOL HOLDERS Are Used in Over 96% of the Machine Shops and Tool Rooms

ONE PIECE Every 90 Seconds

WITH B-C UNGROUND FORMED CUTTER





Calculating machines require some odd-shaped parts. One of the principal profiling cuts on this rotor disc is accomplished on the set-up shown in the photographs.

SAVE MONEY!

PRODUCTION DATA

Name of Part — Rotor Disc
Material — Soft Brass
Thickness of Piece — .2362″
Feed — 5″ per minute
Cutter Speed — 400 r.p.m.
Machine — Brown & Sharpe No. 0
Holding Means — Clamped in Special Fixture in Screw Vise; Piece located by Center Keyed Hole.
Production — 40 pieces per hour.
Pieces per Cutter Grind — 1200.

● Barber-Colman UNGROUND Formed Relieved Milling Cutters are, naturally, lower in cost than the ground type, yet they have an inherent accuracy which is adequate for a great many profiling and form-cutting operations. For instance, on the example shown, the form is held to an accuracy of less than .001″. For freer and faster cutting, we recommend these cutters with *spiral* gashes, and we can provide cutters of this type with accuracy comparable to those with straight gashes. (The cutter shown here has straight gashes.) Barber-Colman Formed Cutters made a name for themselves in World War I on small arms production and the added experience gained on thousands of jobs in the intervening quarter-century is your guarantee of satisfaction.

LET US QUOTE ON YOUR NEEDS

Formed Cutters are generally designed individually for each specific job. If you will furnish full details of the work to be done, we can give you an accurate proposal on cost and results.

BARBER B-C COLMAN

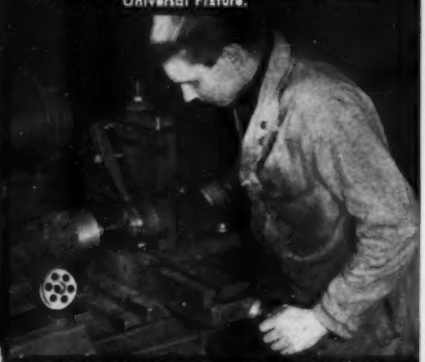
PRODUCTS
MILLING CUTTERS, HOBS, HOBBING MACHINES, HOB SHARPENING MACHINES, REAMERS, REAMER SHARPENING MACHINES, SPECIAL TOOLS

BARBER-COLMAN COMPANY

General Offices and Plant 201 Loomis Street, Rockford, Illinois, U. S. A.

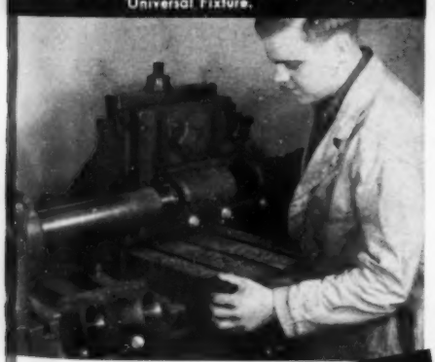
recision boring and facing airplane engine part, with lationship between shoulders and flange rigidly held on Junior Double End Machine . . . with Ex-Cell-O Universal Fixture.

recision boring Diesel part for U. S. Navy, holding enter bore concentric with O. D. and six other holes— n Junior Single End Machine . . . with Ex-Cell-O Universal Fixture.

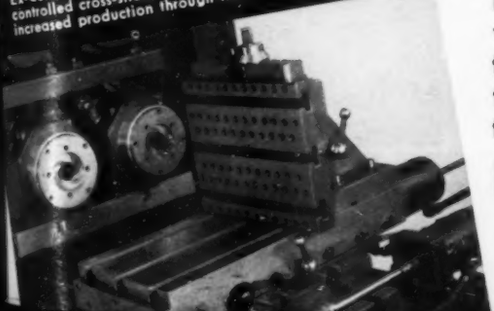


recision boring aircraft part to limits of ±.0002" and olding distance between large and small holes to xtreme exactness—on Junior Single End Machine . . . with Ex-Cell-O Universal Fixture.

recision finish boring machine tool part, with 11 1/16" ngth hole kept parallel to base and dovetail—on leavy Duty Double End Machine . . . with Ex-Cell-O Universal Fixture.



Ex-Cell-O Universal Fixture mounted on hydraulically controlled cross-slide, an automatic feature that means increased production through time-saving in indexing.



A COMBINATION HARD TO BEAT

. . . for precision boring, turning and facing in miscellaneous lots

EX-CELL-O STANDARD BORING MACHINES and UNIVERSAL FIXTURES

MANUFACTURING plants and machine shops with a variety of jobs in different size lots can bore, turn, face and groove with extreme precision in size and finish—with the utmost economy and at a high production rate—by the use of an Ex-Cell-O *standard* Precision Boring Machine and an Ex-Cell-O *standard* Universal Fixture. The same precision in design and operation that makes the Ex-Cell-O Boring Machine a superior machine tool also features the Ex-Cell-O Universal Fixture—used together they are practical and profitable. These two standard Ex-Cell-O products are solving problems for many manufacturers—small and large—whose work calls for the speedy turning out of a variety of parts, with all the advantages that come with the use of single point diamond or carbide tools. The flexibility in application of the Ex-Cell-O Universal Fixture makes it well worth your consideration at this time.

EX-CELL-O CORPORATION • DETROIT, MICHIGAN

Precision **THREAD GRINDING MACHINES**

•

Precision **BORING TURNING and FACING MACHINES**

•

Precision **LAPPING MACHINES**

•

Precision **GRINDING SPINDLES**

•

Precision **CARBIDE TOOL GRINDERS**

•

Precision **HYDRAULIC POWER UNITS**

•

Precision **CUTTING TOOLS**

•

Precision **BROACHES**

•

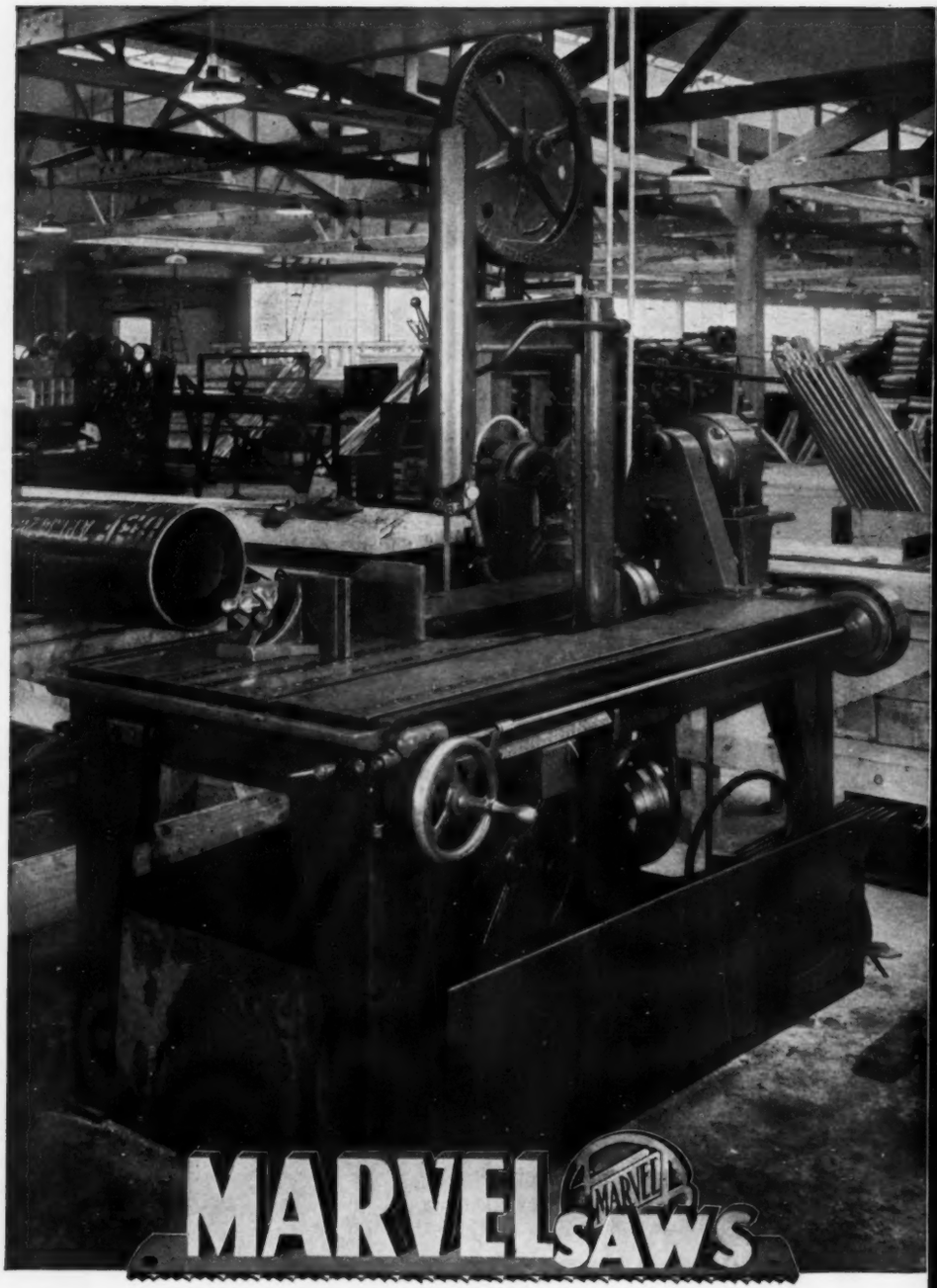
Precision **DRILL JIG BUSHINGS**

•

Precision **PARTS**

XLO

EX-CELL-O *means* PRECISION



"A Great Improvement Over previous cutting methods" says Bell and Gosset Co.

Among the first machine tools installed in the new plant Bell & Gosset Co., manufacturers of hot water heating specialties, have just completed for the manufacture of "B. & G" Hot Water Heating Specialties, was a MARVEL No. 8 Metal-cutting Band Saw—the most universal metal cutting saw built. They report that this saw which they use to cut-off, cut-out and trim 3½", 5", 7" and 10" seamless steel pipe, sheets, plates and castings, "handles the work easily and is a great improvement over the previous method of cutting with a torch."

ARMSTRONG-BLUM MANUFACTURING CO.

"The Hack Saw People"

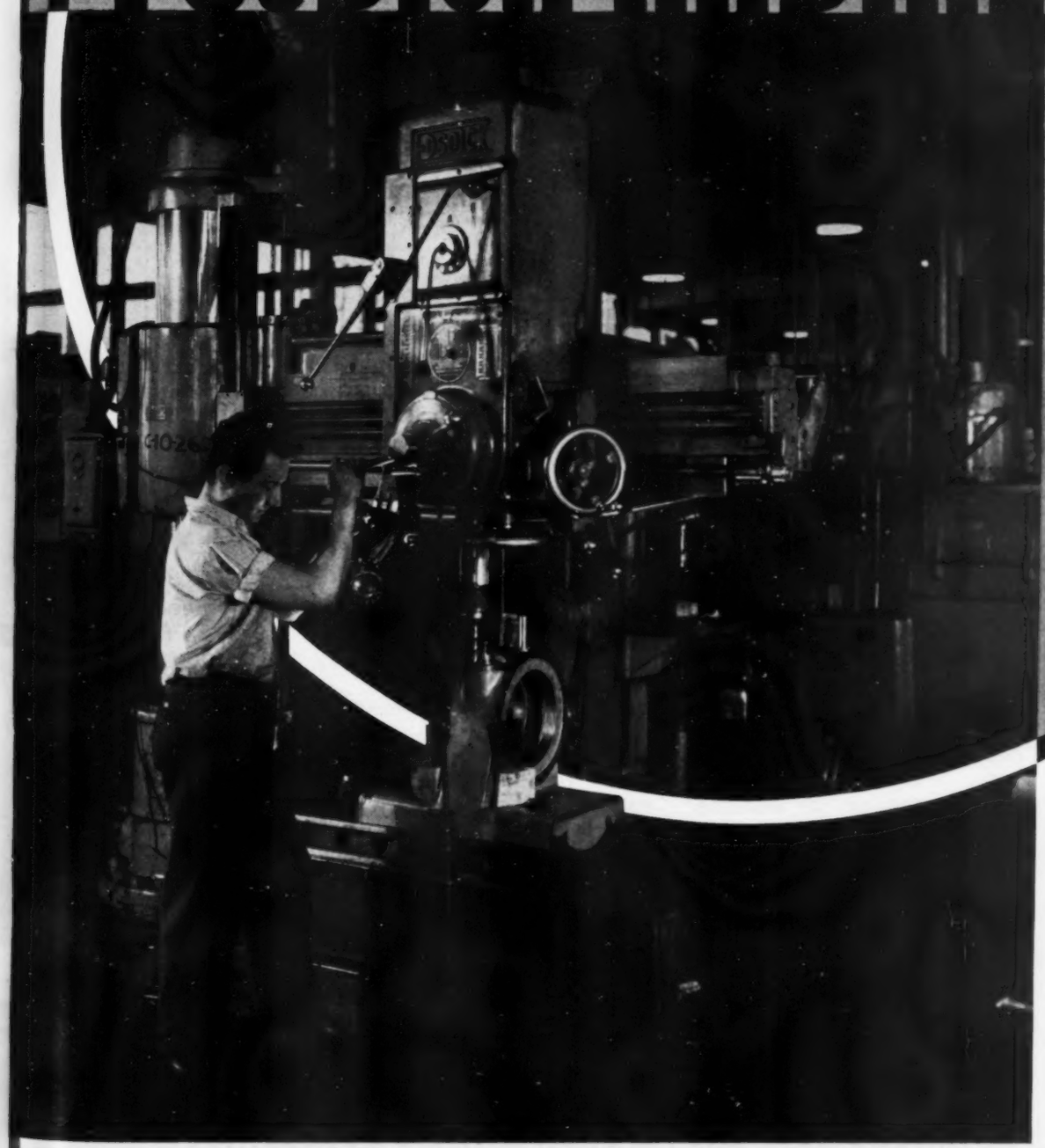
5700 Bloomingdale Ave., Chicago, U.S.A. Eastern Sales Office: 225 Lafayette St., N. Y.

It's EASY TO OPERATE the FOSDICK RADIAL

● Just a glance at the head of this Fosdick Radial shows you why it is easy to operate. The centralization of all operating levers in the head—the design of the levers facilitates quick change of feeds and speeds—the convenient arrangement of hand wheels—all make for efficient and easy operation with minimum fatigue of operator.

This Fosdick Radial is drilling four (4) ½ inch holes in this cast iron wheel head casting for the Sheffield Thread Grinding Machine.

All around utility and wide range adaptability is the main function of Fosdick Radial and Sheffield is taking advantage of these features to step-up production of machines vital to defense.



If the job can be done on a Radial it can be done in a Fosdick. Want details? Write for Radial Drill Bulletin—R.A.

FOSDICK MACHINE TOOL COMPANY
CINCINNATI ··· OHIO

The tactics and grand strategies of modern warfare allow for no exemptions from service. The uniforms, the honors and the insignia of war are the rightful heritage of intrepid youth. But the services of war are the solemn obligation of every man, every machine, every square foot of factory floor space in the entire nation.

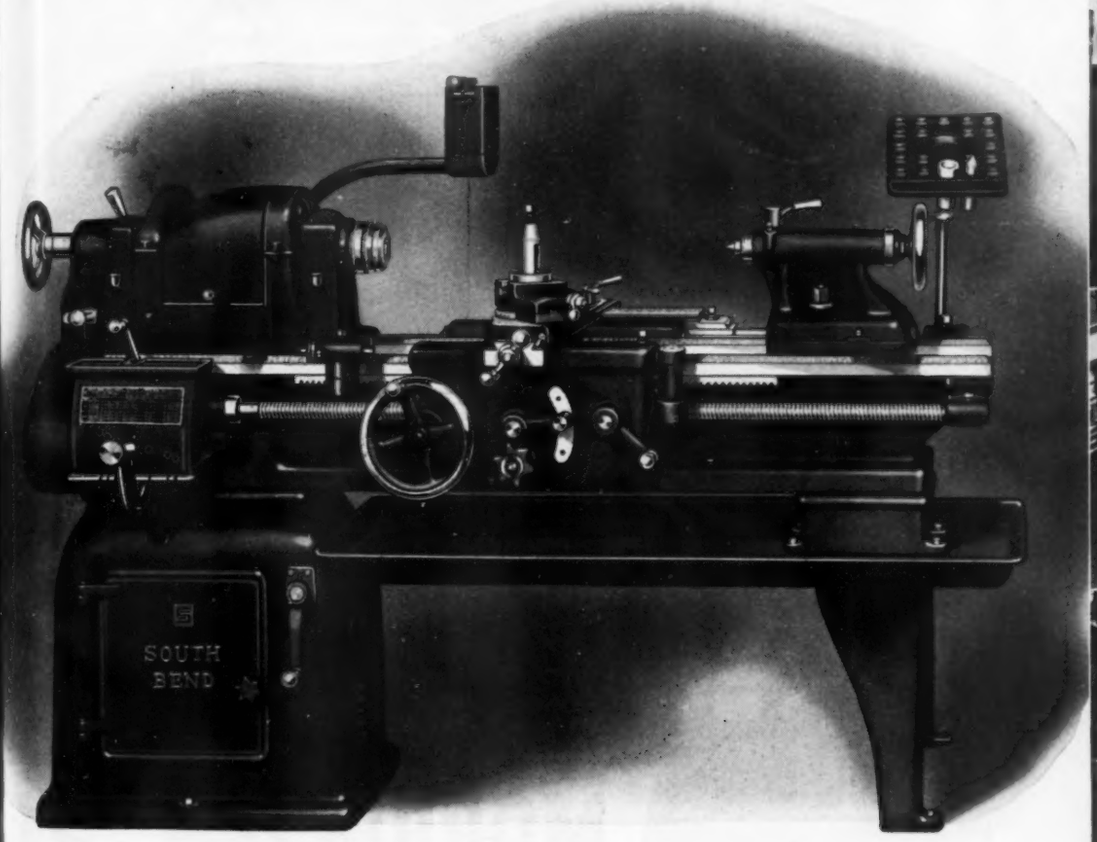
So it is that thousands of able, experienced men of General Machinery Corporation, backed up by countless production machines, are devoting their entire time, their exceptional skill and their years of specialized training to the production of the materials and machines of Defense. They also are in the service for the Duration.

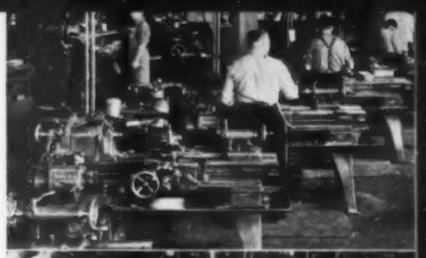
GENERAL MACHINERY CORPORATION

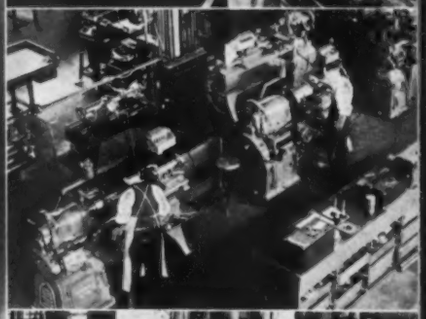
HAMILTON, OHIO

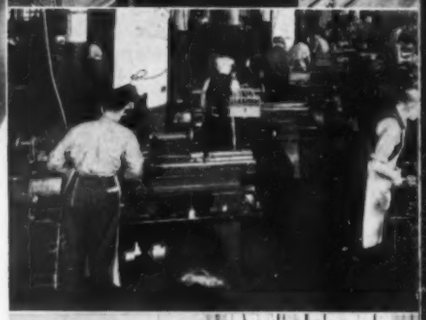
THE NILES TOOL WORKS CO. • THE HOOVEN, OWENS, RENTSCHLER CO.

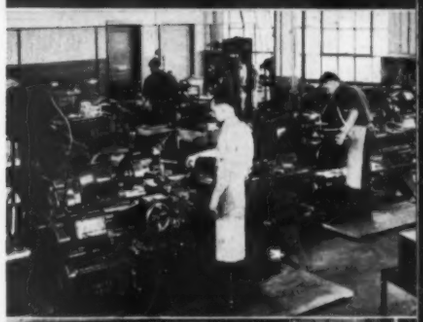
For
MODERN SHOPS

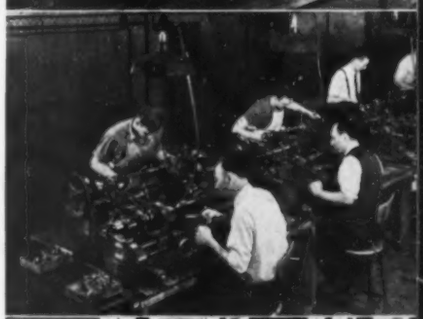












South Bend Lathes

SOUTH BEND LATHES are designed and built to give efficient service in modern shops. Because they are known to be dependable, permanently accurate, and versatile, thousands of them have been ordered for the National Defense Industries, the Army and the Navy—and prompt deliveries have been specified. Production schedules have doubled and redoubled. Delivery promises have been met *and are being met every day!* South Bend Lathes are being made faster than ever before.

But no sacrifice in quality has been made to speed up the production of South Bend Lathes—nor will there be a lowering of our standards. The same rigid inspection tests—the same skilled workmanship—the same high quality materials will be maintained. South Bend Lathes are made in five sizes: 9″, 10″, 13″, 14½″ and 16″ swing, 3′ to 12′ bed lengths, in Tool Room or Manufacturing types, with individual motor drive. Write for a catalog and name of your nearest dealer.

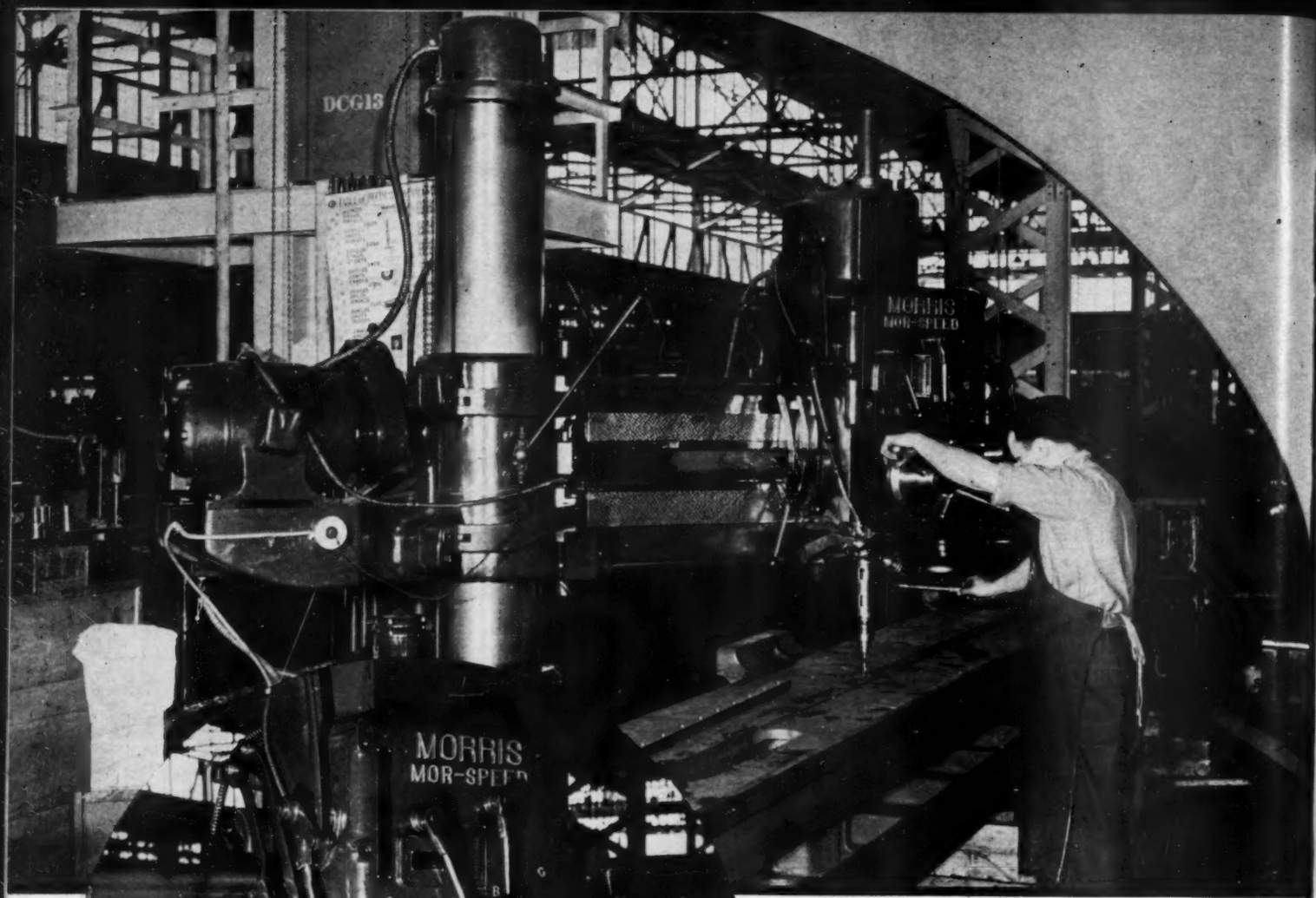
"LET'S GO! U.S.A." "KEEP 'EM FLYING!"

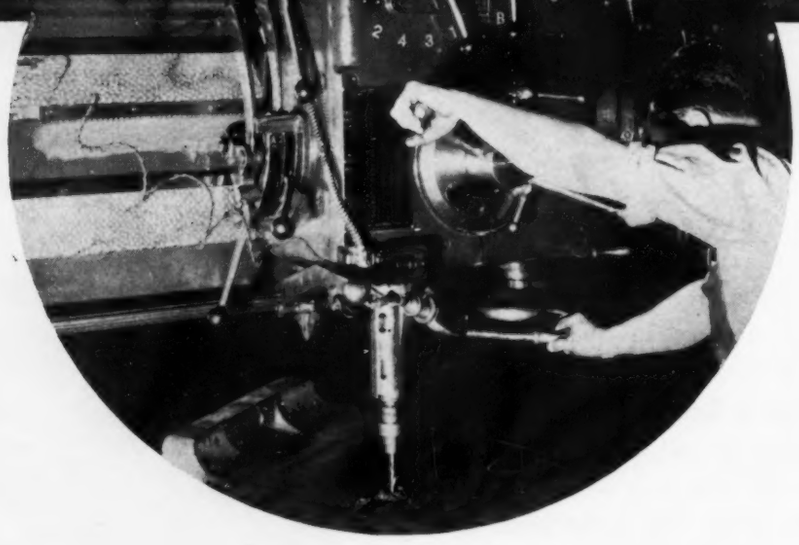
TRADE MARK SOUTH BEND TWINS ENGINE LATHES

SOUTH BEND LATHE WORKS

286 EAST MADISON STREET, SOUTH BEND, INDIANA, U. S. A.

LATHE BUILDERS SINCE 1906





MORRIS *Mor-Speed* RADIAL

helps expand production for Pratt & Whitney

● Illustrated is a 5-foot Morris Mor-Speed Radial drilling numerous holes in a bed casting for a Pratt and Whitney Machine.

Here's a typical example of how Morris Mor-Speed Radials are speeding production of modern machine tools to defense jobs. Rigid base and column construction . . . Balanced Arm and Head Design . . . All power driven parts running in oil . . . Smoother Power . . . Centralized Control . . . Ample Speeds and Feeds for all jobs are a few of the points important to experienced machine tool manufacturers that have also proved valuable to production shops.

For Greater Production –

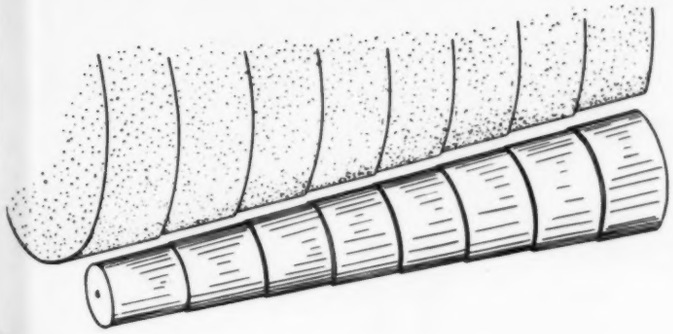
For greater production, in less time, at lower costs; specify Morris Mor-Speed Radials. Bulletin upon request.

Builders of MOR-SPEED *Radials*

The MORRIS *Machine Tool Co.*

CINCINNATI, OHIO

8 DIAMETERS IN 1 OPERATION



Above: This sketch (exaggerated) illustrates how the 11" face wheel is profiled to grind a control rod having 8 diameters.

C-33: A view showing how two work rests support the control rod firmly during grinding.

C-32: A view illustrating how the operator uses the two visual sizing gauges with which the machine is equipped.

"Please advise us the fastest and most accurate way to grind a control rod (print attached) having 8 different tapered diameters. Present production and precision requirements necessitate abandonment of former tedious finishing methods."

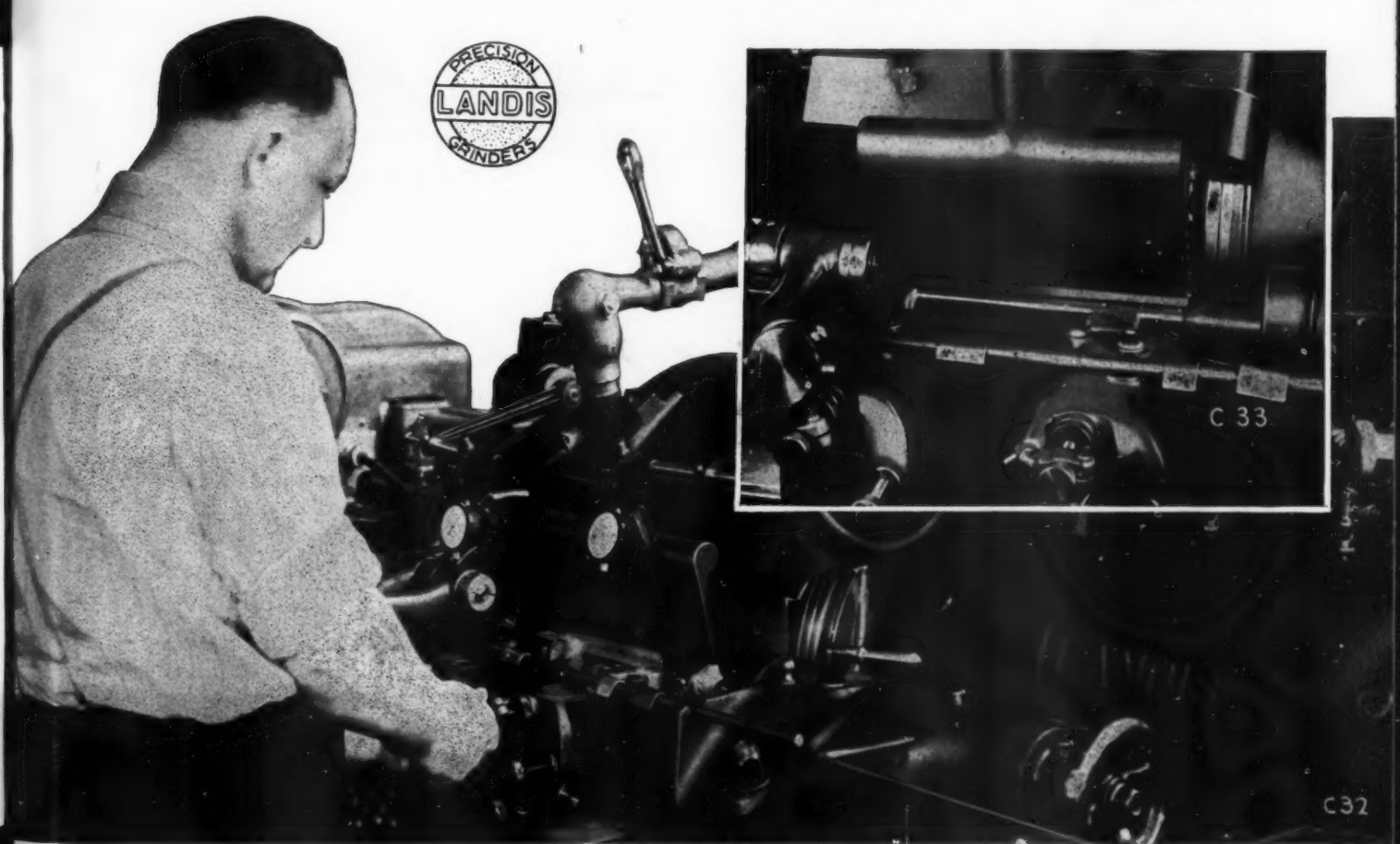
"Most accurate, productive and simple way to grind control rod would be on a Landis 10" x 36" Type DC Plain Grinder using an 11" face wheel profiled to coincide with the 8 diameters on the work. This would mean that all 8 diameters could be ground in one straight infeed grinding operation."

—From an exchange of letters between a Landis Field Man and Landis Sales Engineering Staff.

☆ ☆ ☆

The above machine was recently installed. Not only one, but two different types of control rods are being finish ground to size in one operation within close precision requirements at a high rate of production.

This problem had a simple answer. Yours may appear just as simple after Landis engineers have studied it. You can lose nothing and perhaps gain much by submitting your jobs to Landis for expert recommendations. Try it. 382



LANDIS TOOL COMPANY

YOU can't afford to take chances today with your cutting tools—every minute of useful life from each one is *absolutely essential.* And the grinding wheel is the key to maximum tool life. Sharpening and reconditioning done technically right assures every possible minute of effective service from each tool.

Norton research has developed the correct wheels for every grinding job on every type of cutting tool material—high speed steels, the cast alloys (such as Stellite) and the cemented carbides. And these Norton tool wheels are as near foolproof as wheels can be made for this type of work—a big aid today when the grinding must often be done by help that is not too expert.

Play safe with Norton Wheels on your tool grinding jobs.

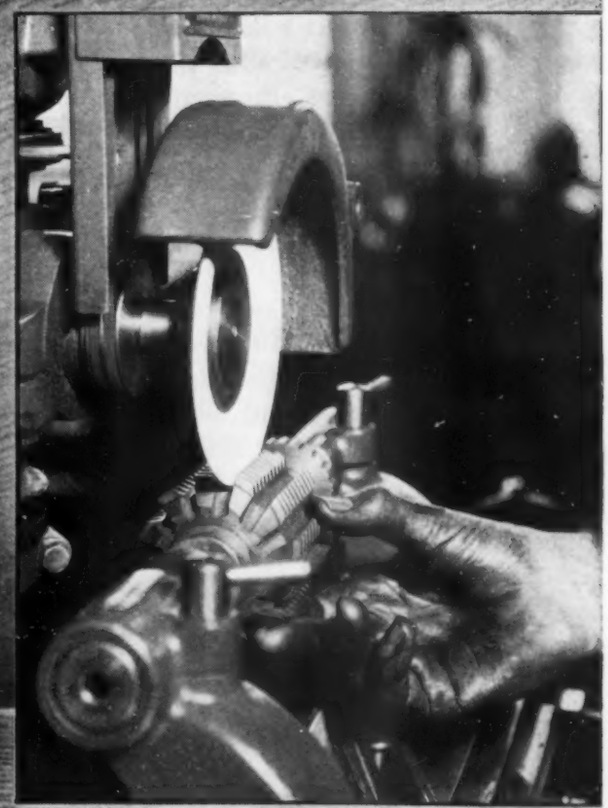
NORTON COMPANY • WORCESTER, MASS.

NORTON ABRASIVES

Cutting Tools!

Grind Correctly with NORTON Wheels

For Cemented Carbide Tools—
two types of Norton Diamond Wheels and Crystolon Wheels.



For High Speed Steel and Stellite Tools—
the patented Norton "B-E" bond plus Alundum abrasive.

"PUT IT ON THE BLANCHARD"

For speed, accuracy, and low cost on your larger surfaces you should investigate the Blanchard No. 27.

This Blanchard No. 27 Surface Grinder, with 42″ segment wheel and 84″ swing, grinds steel and semi-steel die shoes from the rough. The work varies in size but each chuck load, whether one large piece or several small pieces, presents a large area from which 1/8″ to 1/4″ stock must be removed. Because of the competitive nature of the product (standardized die sets) every effort must be made to keep costs low. Loading time is shortened by using a lifting magnet, and the grinding is done at the fastest possible rate. The machine is kept continuously busy and, in addition to die shoes, it machines many large steel plates.

The BLANCHARD
MACHINE COMPANY
64 STATE STREET, CAMBRIDGE, MASS.

Send for your free copy of "Work Done on the Blanchard." This book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

KEMPSMITH *Since* 1888

For 54 Years the By-word for *Milling Machines:* KEMPSMITH

Since 1888, KEMPSMITH has been a world-wide by-word for America's supremacy in Milling Machines. KEMPSMITH *matured experience* now looms soundly on the national horizon for industry, in terms of speeding deliveries of vital machine tools for Defense production. Veterans of traditional KEMPSMITH precision methods . . . men who know what industry demands in modern high-speed milling machine performance . . . now assure precision CONTROL of every detail of materials and workmanship.

Frank Kempsmith
FOUNDER

KEMPSMITH *Today & "Tomorrow"*

Today, in a modern plant, flexible for "production type" or special machines, KEMPSMITH operates on steady 3-shift schedules. "Tomorrow", when Peacetime adjustments come, this flexible KEMPSMITH plant will be in ideal position to swing over, efficiently, to industry's post-war needs... in support of industry's faith that KEMPSMITH will be prepared then, as now, to work with you, for the good of industry and the nation.

Rugged **KEMPSMITH MAXIMILLERS,** with reliable accuracy and extra power for heavy, continuous cuts on long production runs, in Horizontal (Plain or Universal) and Vertical types . . . KEMPSMITH Type G Geared-Head Milling Machines for Tool Room work and lighter production—also Dividing Heads; Heavy Duty Vertical Attachments; High Speed Universal Attachments; Slotting Attachments; Vises; Arbors; Rotary Tables; etc.

KEMPSMITH MAXIMILLER

AVAILABLE IN VERTICAL OR HORIZONTAL TYPES • PLAIN OR UNIVERSAL

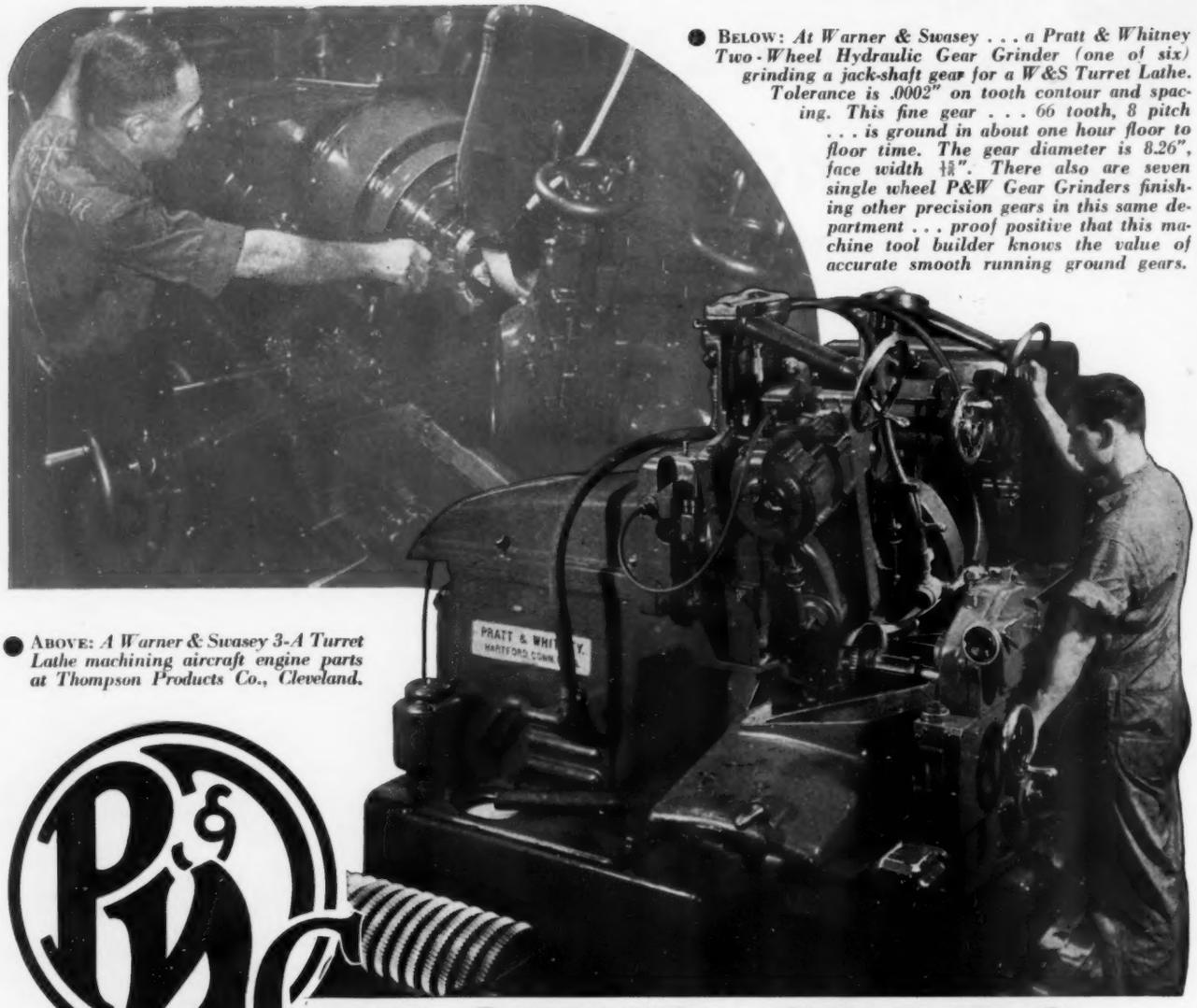
1898 1903 1908 1913 1918 1923 1928 1933 1938 1941 '42

PRECISION

MILLING MACHINERY *Experience*

KEMPSMITH MACHINE CO.

MILWAUKEE • WISCONSIN



● BELOW: *At Warner & Swasey . . . a Pratt & Whitney Two-Wheel Hydraulic Gear Grinder (one of six) grinding a jack-shaft gear for a W&S Turret Lathe. Tolerance is .0002" on tooth contour and spacing. This fine gear . . . 66 tooth, 8 pitch . . . is ground in about one hour floor to floor time. The gear diameter is 8.26", face width 1⅛". There also are seven single wheel P&W Gear Grinders finishing other precision gears in this same department . . . proof positive that this machine tool builder knows the value of accurate smooth running ground gears.*

● ABOVE: *A Warner & Swasey 3-A Turret Lathe machining aircraft engine parts at Thompson Products Co., Cleveland.*

P&W GROUND GEARS . . .

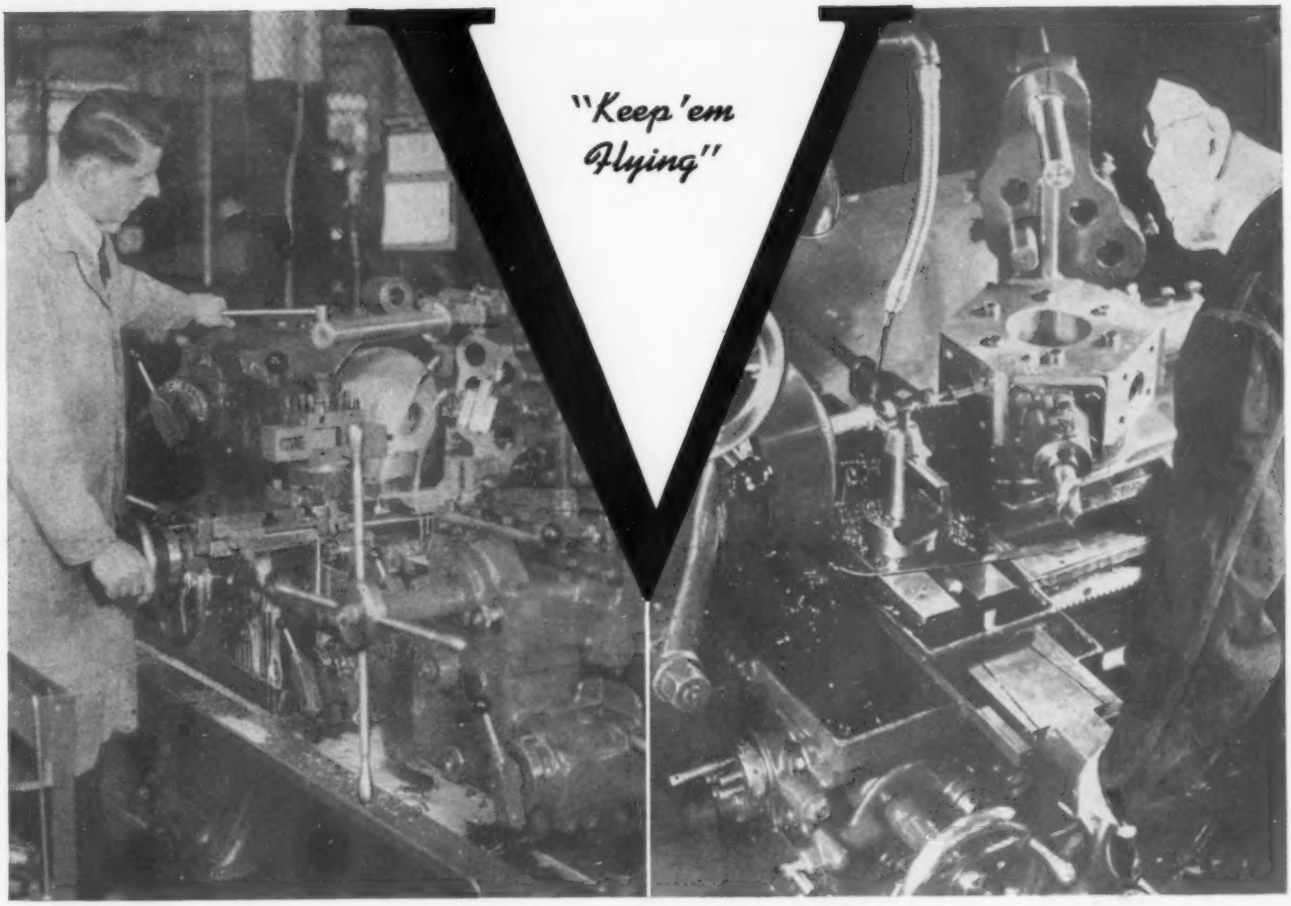
Responsibility for building the thousands of machine tools that are behind the national defense program rests squarely on the shoulders of about 150 manufacturers. The machines these men build must keep going 24 hours a day, smoothly and accurately, carrying a tremendous burden. Machine tool men know the value of precision—it's a "must" in our industry—because if the work is to be good the machine has to be right.

When it comes to gears for machine tools there is no substitute for grinding. Good gears are heat treated to bring out every bit of strength and toughness . . . and that heat treating distorts the gear. It is unavoidable. Grinding eliminates those distortions . . . leaves the teeth smooth, accurate, free rolling, able to stand up under the heavy service they must face.

At Warner & Swasey, at Gisholt, at Jones & Lamson they know this, and use ground gears. We at Pratt & Whitney also use ground gears in our own machine tools . . . and there are many other machine tool builders who do likewise. The performance of these machine tools in every phase of the emergency program is complete proof that "ground gears make good machine tools better."

For complete information on Pratt & Whitney Gear Grinders write to PRATT & WHITNEY, Division Niles-Bement-Pond Company, West Hartford, Conn.

PRATT & WHITNEY

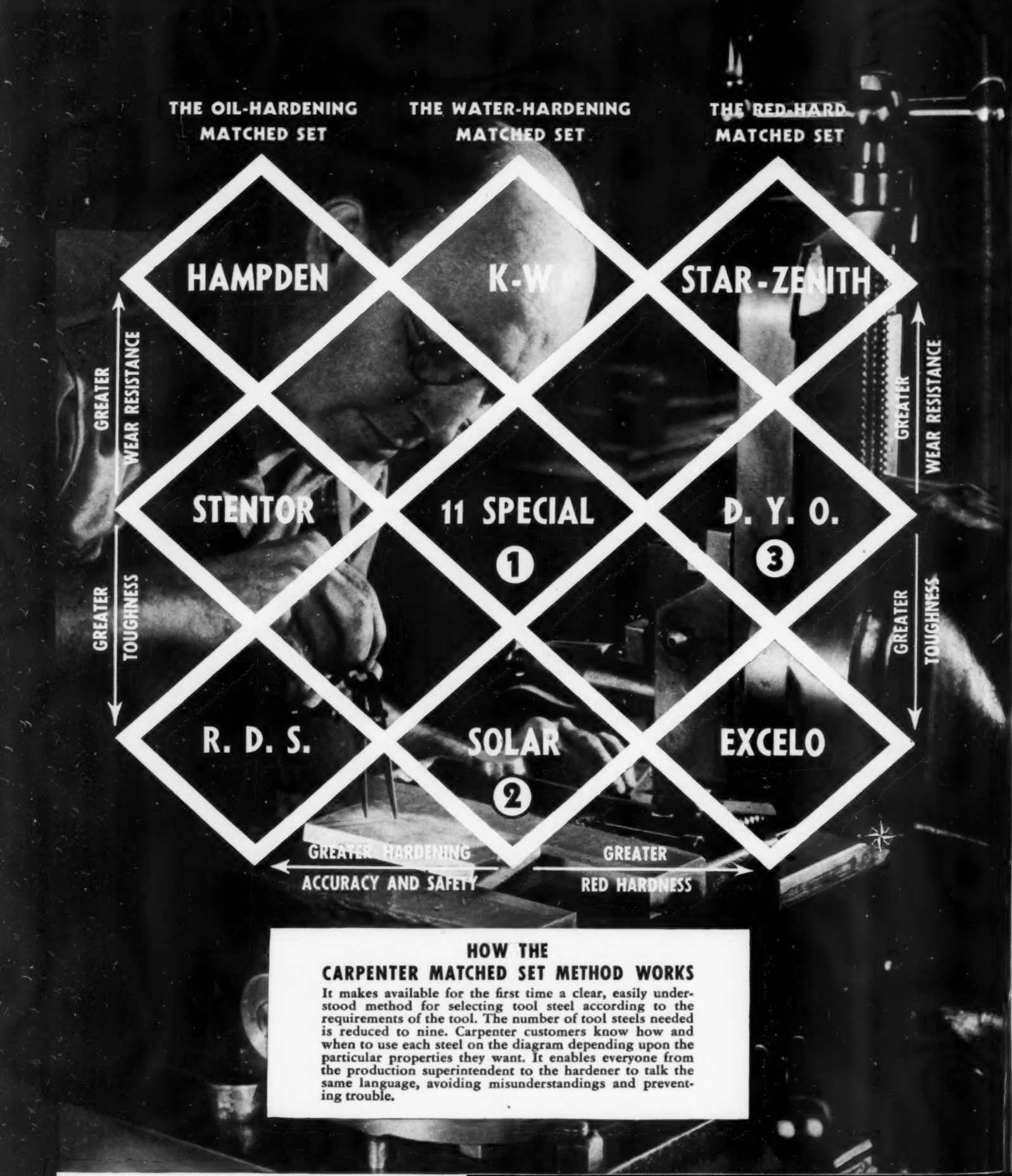


● *Here is a Jones & Lamson No. 5 Universal Turret Lathe machining labyrinth shields using cemented carbide tools. P&W ground gears in this well known machine tool provide the smooth accurate power transmission so necessary for efficient operation.*

● *This Gisholt No. 4 Ram Type Universal Turret Lathe is widely used on miscellaneous small lot work vital in national defense. Here again gears finished on P&W grinders provide quiet, powerful, trouble free operation. Machine tool builders know the relation of accuracy to performance.*

Make Good Machine Tools *Better!*

GEAR GRINDERS



HOW THE CARPENTER MATCHED SET METHOD WORKS

It makes available for the first time a clear, easily understood method for selecting tool steel according to the requirements of the tool. The number of tool steels needed is reduced to nine. Carpenter customers know how and when to use each steel on the diagram depending upon the particular properties they want. It enables everyone from the production superintendent to the hardener to talk the same language, avoiding misunderstandings and preventing trouble.

The Standard Tool Steels of Industry

Carpenter

HOW INDUSTRY IS GETTING

Improved Tool Performance

WITH THE *Carpenter* MATCHED SET METHOD

More than 1500 metal working plants are cashing in today on the benefits of this simplified method of tool steel selection to get faster tooling, increased output per tool, and added capacity for tools and presses.

In 1935 the Matched Set Method was a revolutionary idea—just as many other Carpenter developments have been—but quickly the idea "caught on" with the men responsible for tools. As more and more of these men discovered how tool performance could be improved—they began to adopt this new method in their tool rooms. From their experience they know that fewer tool steels *properly matched* will take the place of the hundreds of types formerly used.

Today, the Carpenter Matched Set Method is the standard pattern for simplified tool steel selection. But it has taken more than a pattern to achieve the outstanding results that are continually being credited to Carpenter Matched Tool Steels. Four important Carpenter developments each contribute their share to insure these results. (Note the four at the right.) Even under the pressure of national defense requirements, and greatly expanded mill facilities, Carpenter's vigilance over these safeguards has not been relaxed. We know, and you know, that only the best tool steel is good enough for defense needs.

THE CARPENTER STEEL COMPANY, READING, PA.

BEHIND THE METHOD ARE THESE 4 CARPENTER DEVELOPMENTS

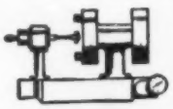
NEW EYES FOR INSPECTION

More than a decade ago, Carpenter discarded the old crop end fracture test. This was replaced by the acid etched hardened fracture disc inspection—to find trouble before it happens—allowing only clean, sound, dependable steel to bear the label of a Carpenter Matched Tool Steel.

TOOL STEEL'S FOURTH DIMENSION

Second only to analysis in importance is Tough Timbre.

This extra margin of safety in hardening now makes it possible to get a wider range of applications, necessary for matched tool steels. They're not matched tool steels unless they completely cover the diamond.

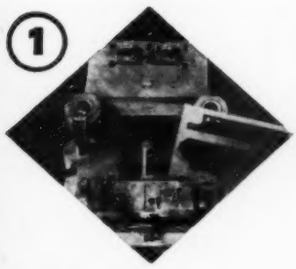


IMPROVED HEAT TREATING FOR BETTER TOOL PERFORMANCE

In 1933, Carpenter announced a new yardstick for measuring heat treating results—the Carpenter Torsion Impact machine. By means of research data gathered from the use of this machine—detailed heat treating instructions have been developed for each Matched Tool Steel. Trouble in hardening is avoided and maximum performance results are assured by easy to follow, printed instructions. This gives you closer control in selection of your starting point on the Matched Set Diagram.

THEY ACTUALLY MATCH

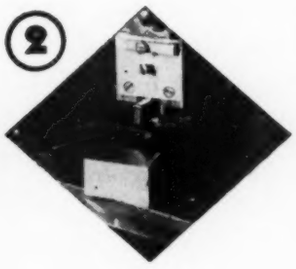
Obviously, the success of a Matched Set Method finally depends upon the availability of tool steels so matched that each must be able to pick up its job where the other leaves off. Carpenter Matched Tool Steels dovetail—each has been developed to a capacity that completely covers the diamond to which it is assigned. The combined properties of these nine tool steels completely cover the normal requirements of all tool rooms.



The Job: Forming and blanking condenser wing brackets out of 3/32" thick brass strip with a progressive die.

The Problem: Selecting the right tool steel for a new job, to prevent trouble before it started. Burrs and excessive stoning had to be guarded against.

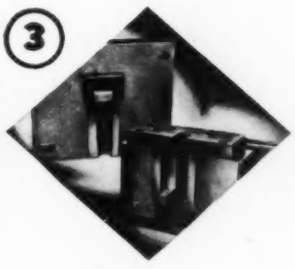
The Matched Set Solution: Striving for a balance of toughness and wear resistance, they selected No. 11 Special. Results: No shutdown time caused by the tool for nearly a year—275,000 pieces, a year's production, with the same tool . . . thanks to the Matched Set Method.



The Job: Punching and coining a small part at the rate of 1,500 pieces per hour.

The Problem: Tool breakage and excessive trouble with burrs every 500 pieces. One hour needed to replace broken tool . . . or about six idle press hours per day.

The Matched Set Solution: Press shutdown time reduced approximately 124 hours per month—accounting for extra output of 185,000 pieces monthly. Tool life increased from 500 pieces to 10,000 pieces. (And tool was still not in need of regrinding at the 10,000 mark.)



The Job: Upsetting and offsetting dies used for hot forming the heads of manganese copper pins at tool temperatures between 1,000° and 1,200°F.

The Problem: High speed steel dies broke after a dozen pieces. Other steels did better but made further machining of the pins necessary.

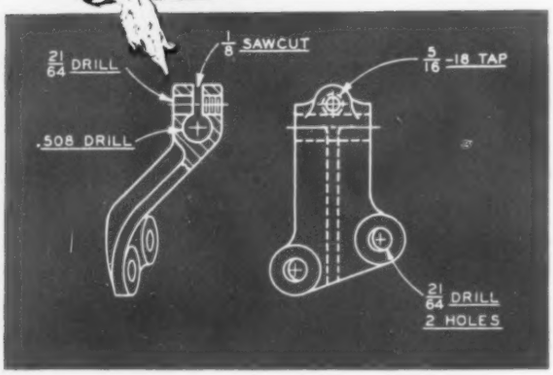
The Matched Set Solution: The Matched Set Method showed that Carpenter D.Y.O. was the strongest hot working steel at temperatures above 900°F. At first report the D.Y.O. die had run 8,500 pieces in a year. Three years later the same die was still in use . . . and still eliminating secondary machining of the pins!

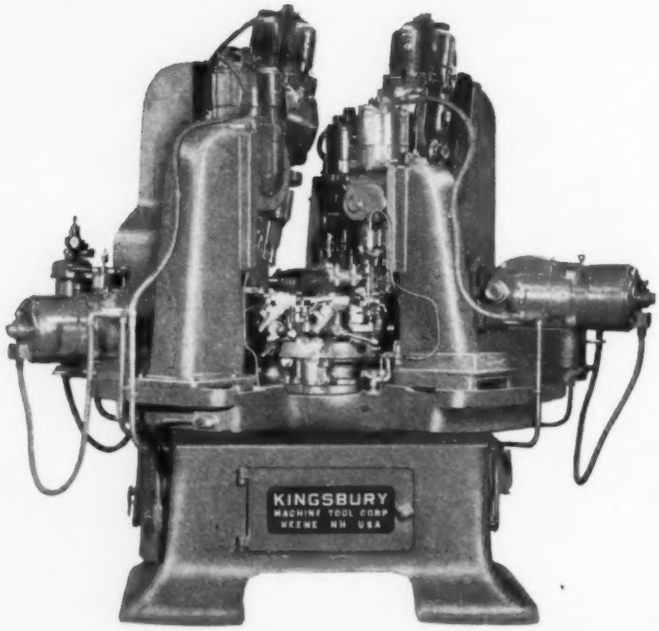
MATCHED TOOL STEELS

FLEXIMATIC

by KINGSBURY

THIS IS A **FLEXIMATIC JOB!**





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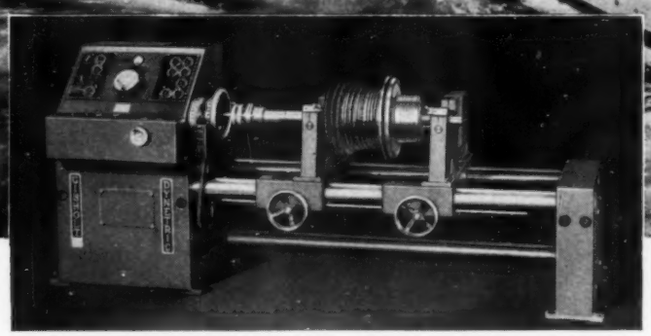
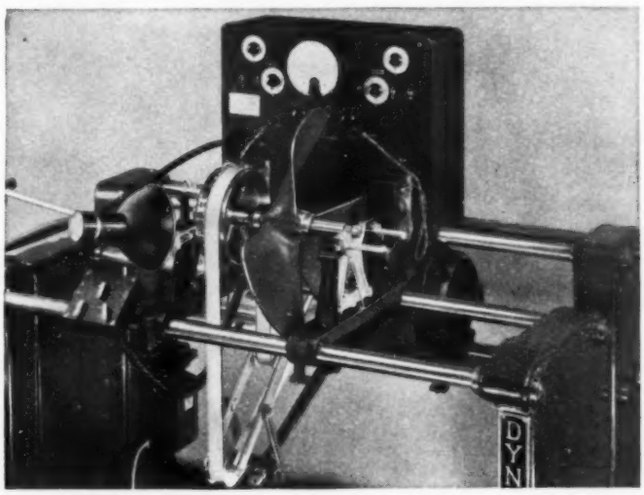


The large Type U Dynetric, shown above, is used for the static and dynamic balancing of turbine rotors, large armatures, and numerous other heavy rotating parts.



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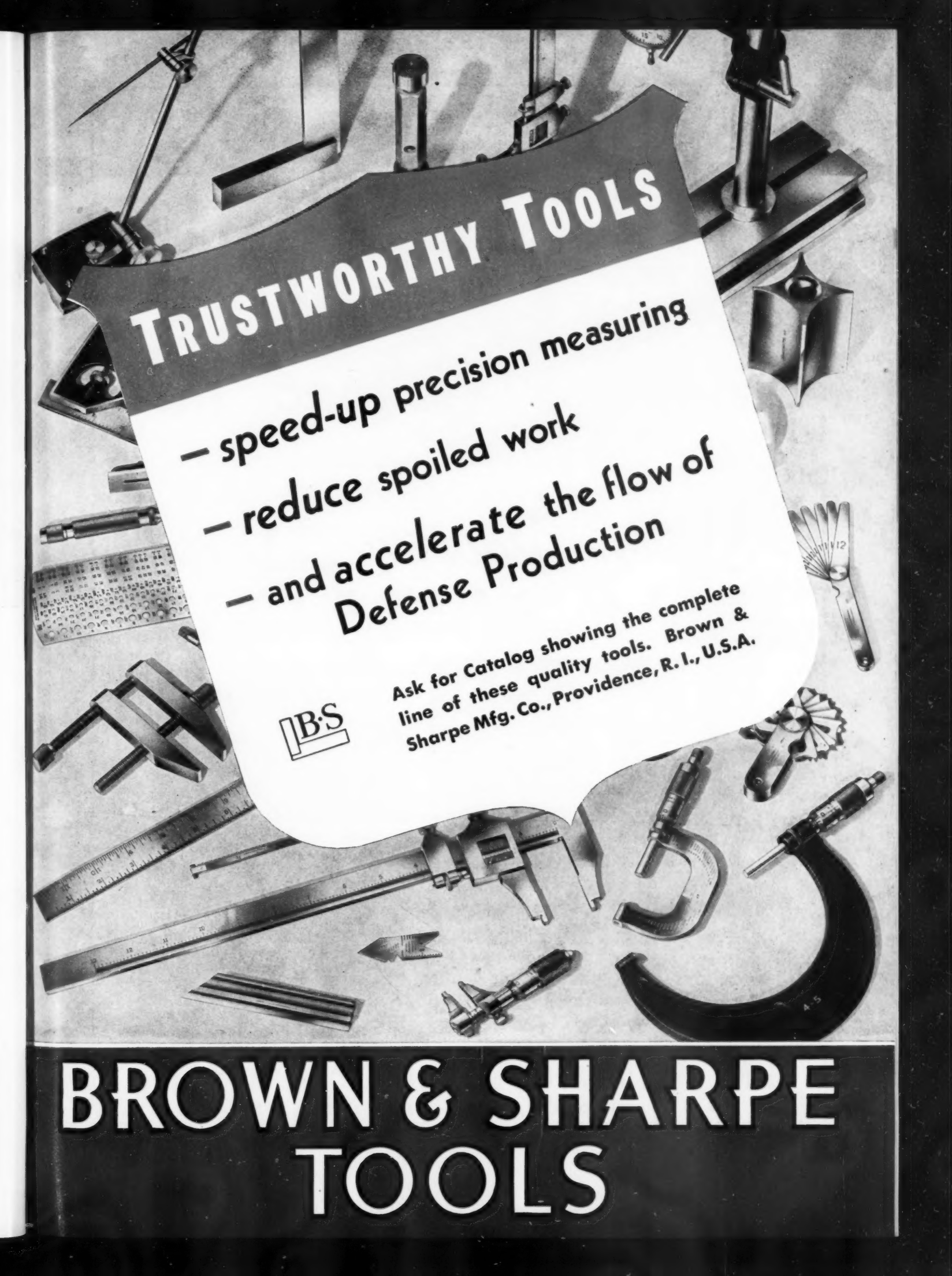
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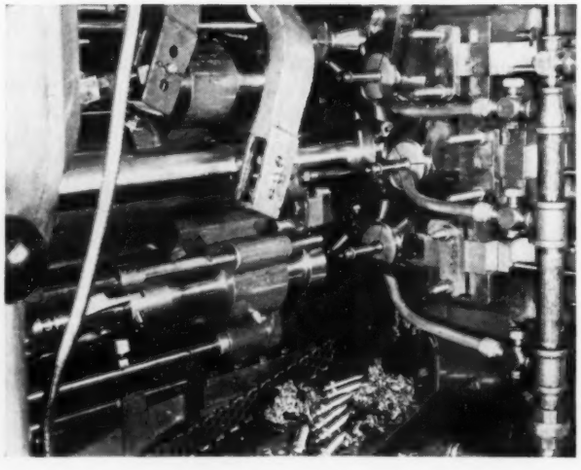
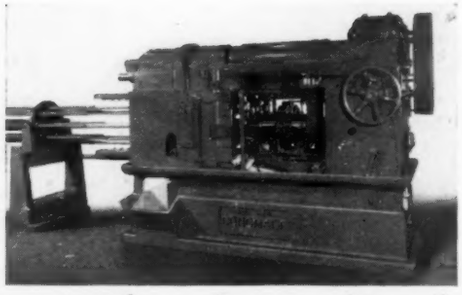
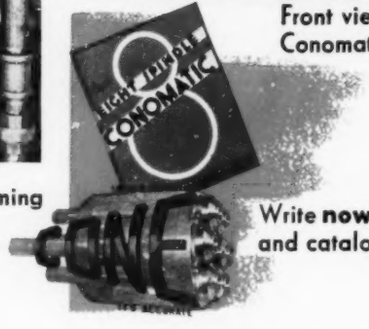


20 millimeter shell bodies coming from 8 spindle Conomatic.



Front view of 8 spindle Conomatic.



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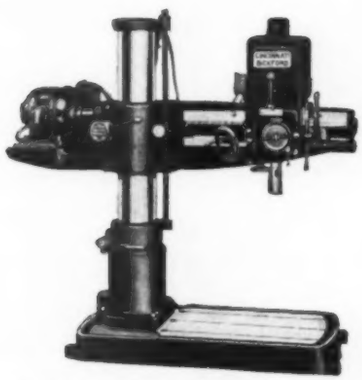

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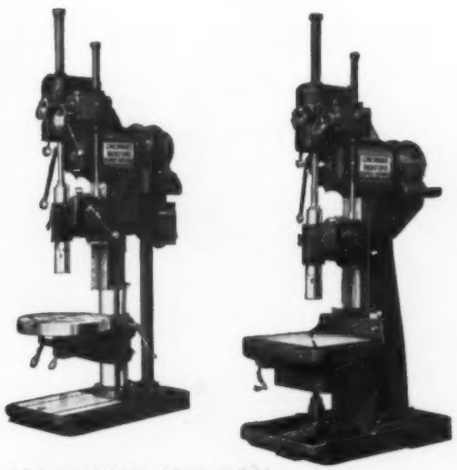

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OPERATOR TRAINING Through PICTURES - TEXT BOOKS - PERSONAL MAILINGS

WHAT'S IN THIS ISSUE

THE RIGHT ROD

One objective in arc welding is to produce the best weld in the shortest time. A lot depends on using the correct welding rod for each job, but there are so many kinds on the market that it is often difficult to make the right selection. Max R. Soth, Westinghouse Electric & Manufacturing Company, gives some helpful pointers on page 1. The proper choice of rods will give a weld with improved physical properties and better appearance at a decreased cost.

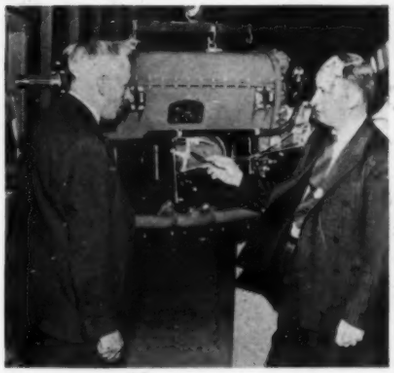
MORE ON CUTTERS

Roy E. Wise, deputy controller of machine tools, Ottawa, Canada, concludes his three-part series on the preservation of cutting tools in an article on their correct application. Mr. Wise is credited with avoiding a critical choke point in Canadian production by supervising the use of cutters in Canadian plants. His advice should save many tool-hours elsewhere. Read what he has to say beginning page 4.

JAMES A. HARRIS, Vega Airplane Company, examines sheet-metal parts blanked and formed with Kirksite dies

AIRCRAFT DIES

The Armament Section in this issue contains three articles on aircraft. James A. Harris, foreman, Hammer Foundry & Press Department, Vega Airplane Company, tells about his experience with Kirksite dies. By their use he has been able to increase the use of punch presses on sheet metal parts without incurring the high cost of steel dies. What's more, he's been able to turn out these dies in record time. Read about it on page 15.



JOSEPH E. BABCOCK, (right) Menasco's plant manager, discusses a throttle problem with Flying Officer B. I. Barton, Canadian Royal Air Force

ENGINES FOR TRAINERS

The second aircraft article deals with the manufacture of low horsepower engines used in U. S. and Canadian army training planes. Just because the engines are not designed for actual conflict, does not mean that there is any slighting of the quality requirements. Precise machining and rigid inspection, as applied to every part of these engines, is explained by Joseph E. Babcock, plant manager, Menasco Manufacturing Company, on page 20.

NAZI METHODS

This is probably one of the last manufacturing articles to come out of Germany. Paul H. Wilkinson, the author, spent a lot of time in European aircraft factories and left shortly before the start of hostilities. He is now aviation specialist in the New York State Division of Contract Distribution. He explains the use of assembly jigs in German aircraft plants on page 26.

IDEAS IN PICTURES

Job welding shops will be interested in the combination welding and gas-cutting table shown on page 6. This homemade device is just one of a number of ideas presented in pictures.

JUST A MINUTE

There's a lot of satisfaction in reading short items. They take little time and often yield big results in workable suggestions. The concise review of salt bath applications on page 46 is a good example.

SPINNING FOR HARDNESS

One of the best ways of using flame hardening is by means of spinning the workpiece while the entire surface to be treated is hardened at one time. How it's done and the advantages obtained are fully described by J. G. Magrath, Air Reduction Company, in another installment on "Oxyacetylene Flame Hardening." A valuable feature of these articles is the excellent line drawings which make clear each step in the process. See page 8.

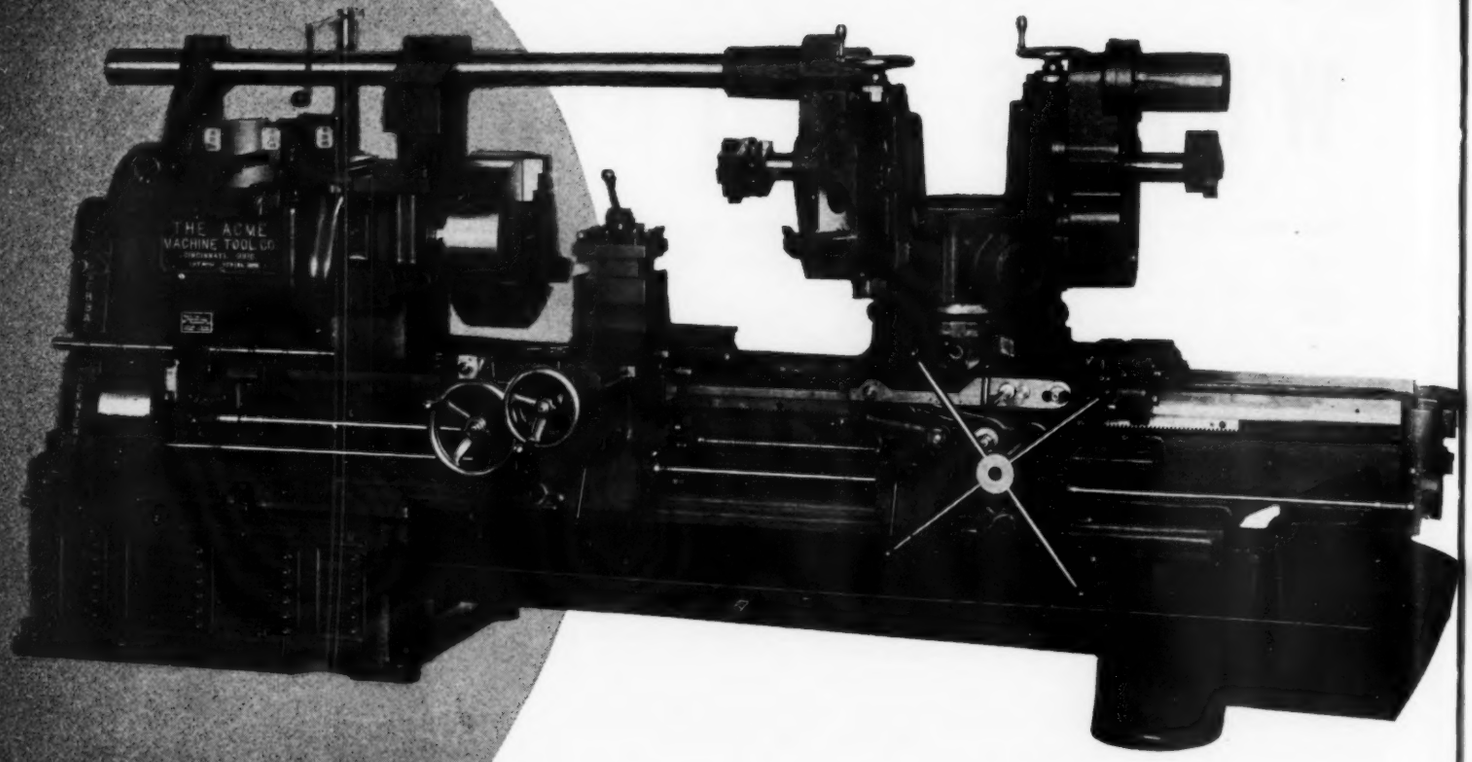
PAUL H. WILKINSON

WARTIME IN WASHINGTON

One of our departmental features now appears under a new head. "Watching Washington" has been rechristened "Wartime Washington." This page (34i) will continue to interpret current happenings in the Nation's capital, with increased emphasis on news of the war effort.

COMING

Next issue is our Annual Buyers' Reference Number. In it the new equipment, materials, tools and processes that were described in the pages of AMERICAN MACHINIST during 1941 will be summarized by picture and caption. Included also will be the Buyers' Guide, a compilation of suppliers of machines, accessories and materials that is of help in finding out where to get what you need. This number is something to keep on your desk for the next twelve months.



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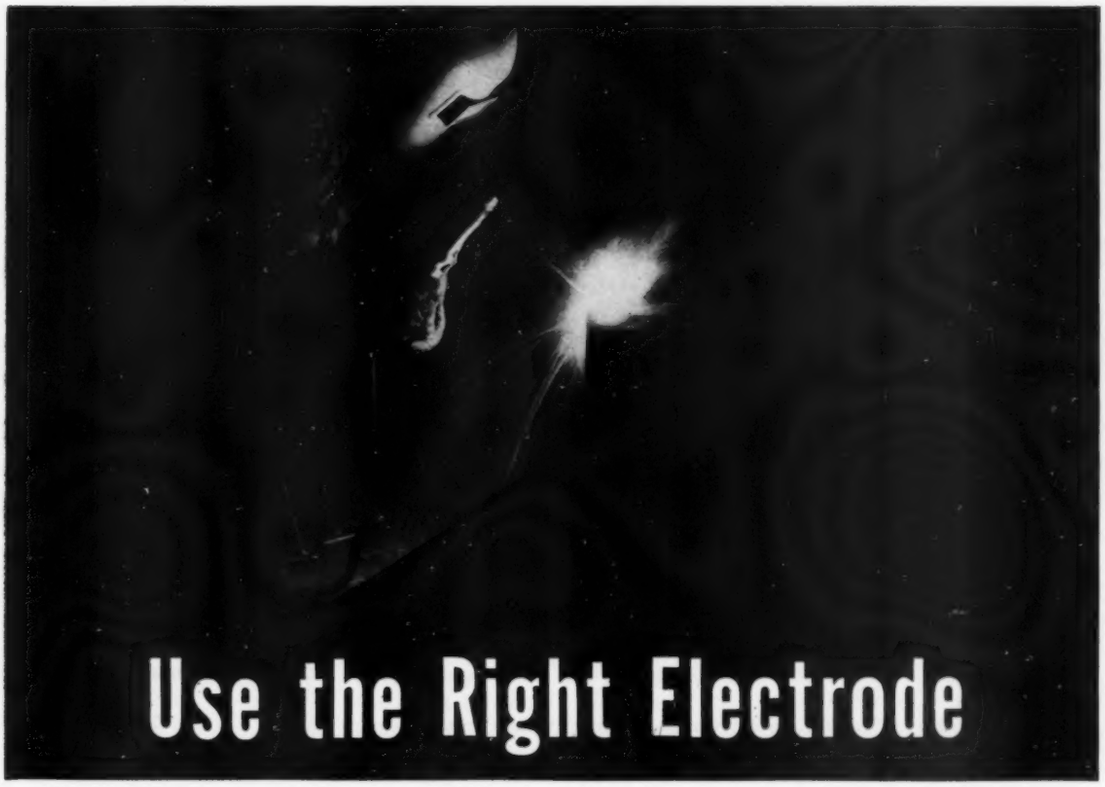
ESTABLISHED 1877 **AMERICAN MACHINIST** BURNHAM FINNEY, Editor



Use the Right Electrode

BY MAX R. SOTH, WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY

Electrodes are classified to help in selecting the right rod for each welding job. The correct choice means faster welding and reduced production costs

SELECTION of a suitable electrode for a given welding job involves several factors: (1) type of welding machine to be used—alternating current or direct current; (2) physical properties—tensile strength, yield point, ductility—required in the welded joint; (3) whether the weld be made in a single pass or whether several passes must be made to build a weld of the correct size; (4) whether there is sufficient volume of welding to justify positioning equipment; (5) whether the work lends itself to positioning; (7) whether the members fit closely or the weld metal must bridge a poorly fit joint. Other factors must be considered also. Conspicuously absent is the kind of metal to be welded. For the time being, the answer will be limited to mild steel of approximately 0.15 percent carbon.

Table I gives a classification and description of arc-welding electrodes for mild steel according to application and physical characteristics of deposited metal. This table, jointly prepared by the American Society for Testing Materials and the American Welding Society, is a part of their "Tentative Specifications for Iron and Steel Arc-Welding Electrodes." The last four classifications listed in the table are for bare electrodes. They are so limited in their application, because of the poor physical properties of the deposited metal, they need not be considered further.

Now to weigh the factors in selecting heavy coated electrodes for welding mild steel: The question of selecting an electrode for a.c. welding is no longer the problem it was only a few years ago. Because of the rapid growth of a.c. welding, electrode manufacturers have had to change the analysis of their electrode coatings to make their rods operate satisfactorily with alternating current. They have done this, except in classification E6011, for which a satisfactory electrode has not yet been developed. The direct-current counterpart of this rod, class E6010, is very successful and is used primarily by shipbuilders, boilermakers and pipe fabricators, who require an all-position electrode which will give a high ductility deposit. The lack of an E6011 electrode is perhaps one of the chief reasons for the absence of a.c. welding in these industries.

Ductility of the deposit is one of the major considerations in selecting the correct electrode. Because all heavily coated electrodes produce much more ductile welds than bare rods, they have made it possible for arc welding to invade fields of application previously close to it. Nevertheless there is still

enough difference in the ductility of the various classes of coated electrode to justify the careful selection of the correct one for a given application. For locomotive and railroad-car frames and any equipment subjected to excessive vibration, an electrode of class E6020 or E6030 should be used if the work can possibly be placed so that welding can be done in the flat or horizontal-fillet positions. For field pipe welding, ship hull and boiler welding, and other work on which the operator is forced to use an all-position electrode, but must also obtain a high ductility, deposit, class E6010 electrode should be used.

The greatest volume of welding is done with an electrode that meets both the E6012 and E6013 classifications; frequently it meets the E7010 and E7011 classifications as well. As noted from the table, it is capable of producing satisfactory welds in vertical, flat, horizontal and overhead positions. Therefore, it is the answer to the prayer of the job-shop welder and the maintenance welder. The job-shop man may have a small a.c. welder for work in his shop and an engine-driven d.c. machine for his field work. This rod will work for him in both places. Likewise, the plant maintenance man may have an a.c. welder in the maintenance shop and an a.c.-d.c. portable motor-generator d.c. welder for "on the spot" work in the plant. This general-purpose all-position electrode will be all he wants in the mild-steel line. But it is not only a maintenance and repair electrode. It is used extensively for production work. Machine bases and bedplates, car and truck bodies, fabricated steel machine housings to replace solid steel castings and a host of other production items are welded with this type of electrode. However, all-position electrodes of both the high-ductility and medium-ductility types are used in many applications where manufacturers could realize outstanding economies by converting to the flat or horizontal-fillet electrodes, classes E6020 and E6030.

Most welding men agree that $\frac{3}{16}$ in. is about the maximum diameter electrode for satisfactory vertical and overhead work. This means that several passes must be made to deposit a $\frac{3}{8}$- or $\frac{1}{2}$-in. fillet weld. Positioning of the work so that these welds can be made in the downhand position permits the use of larger electrodes and higher cur-

TENSILE REQUIREMENTS OF DEPOSITED METAL

Electrode classification number	Position in which satisfactory welds can be produced*	General description	Treatment of welded specimen†	Tensile requirements of material deposited from 5/32, 3/16 and 7/32 in. electrodes: Minimum tensile strength, lb. per sq. in.**	Tensile requirements of material deposited from 5/32, 3/16 and 7/32 in. electrodes: Minimum elongation in 2 in., per-cent§
E7010	F,V,OH,H	Heavy covering, useful with d.c., electrode positive only	SR	70,000	22
			NSR	75,000	17
E7011	F,V,OH,H	Heavy covering, useful with d.c., either polarity, or with a.c.	SR	70,000	22
			NSR	75,000	17
E7020	H-fillets,F	Heavy covering, usually used with electrode negative or a.c. for fillets, and electrode positive or a.c. for flat welding	SR	70,000	25
			NSR	75,000	20
E7030	F	Heavy covering, usually used with electrode positive on d.c. or with a.c.	SR	70,000	25
			NSR	75,000	20
E6010	F,V,OH,H	Heavy covering, useful with d.c., electrode positive only	SR	60,000	27
			NSR	65,000	22
E6011	F,V,OH,H	Heavy covering, useful with d.c., either polarity, or with a.c.	SR	60,000	27
			NSR	65,000	22
E6012	F,V,OH,H	Heavy covering, usually used with electrode negative, d.c. or on a.c.	SR	60,000	22
			NSR	65,000	17
E6013	F,V,OH,H	Heavy covering, usually used on a.c.	SR	60,000	22
			NSR	65,000	17
E6020	H-fillets,F	Heavy covering, usually used with electrode negative or a.c. for fillets, and electrode positive or a.c. for flat welding	SR	60,000	30
			NSR	65,000	25
E6030	F	Heavy covering, usually used with electrode positive on d.c., or with a.c.	SR	60,000	30
			NSR	65,000	25
E4510	F,V,OH,H	Wire with coating applied before drawing	NSR	45,000	5
E4511	F,V,OH,H	Wire with light coating applied after drawing	NSR	45,000	5
E4520	H-fillets,F	Wire with coating applied before drawing	NSR	45,000	5
E4521	H-fillets,F	Wire with light coating applied after drawing	NSR	45,000	5

* Abb. indicate welding positions as follows: F — flat; V — vertical; H — horiz.; OH — overhead; H-fillets — horiz. fillets.

† The abbreviations SR and NSR signify stress-relieved and non-stress-relieved, respectively. Stress-relieving when prescribed in these specifications is for the purpose of developing the fundamental properties of the weld metal unaltered by locked-up stress. Values obtained from stress-relieved welded specimens are about 5 percent lower in tensile strength and 10 to 20 percent higher in elongation than those of non-stress-relieved specimens. The fact that an electrode test requires stress-relief signifies only that it must develop the strength required regardless of stress-relief, and not that stress-relief must always be used in actual work. Stress-relieving shall be within the range of 1,150±25 F. for 1 hr. per in. of thickness. Specimens shall be heated at the rate of 300 to 350 F. per hr. and cooled at the same rate to 300 F. No specimen shall be heated less than 1 hr.

** The tensile strength of the deposited metal from $\frac{1}{8}$-in. electrodes shall be 105 percent of that prescribed in this table, and that from $\frac{1}{4}$-in. and larger electrodes shall be 95 percent of the tensile strength prescribed.

§ The elongation of the deposited metal from $\frac{1}{8}$-in. electrodes shall be 90 percent of that prescribed in this table, and that from $\frac{1}{4}$-in. and larger electrodes shall be 110 percent of the elongation prescribed.

rent. Fewer passes are required to make the correct-size fillet with a resultant saving in welding time. It is also well known among welders that deposition rates for vertical and overhead welding are lower than for downhand or horizontal-fillet work. One question might be raised here: Is'nt the vertical weld from the top downward made with greater speed than the horizontal or flat weld? It is made with greater speed in feet per minute, but the deposition rate, measured in pounds of deposited metal per hour, is actually lower because this procedure develops a small concave weld. To build a ¼- or ⅜-in. vertical fillet would require repeated downward passes or the relatively slow upward weaving process.

Welding positioners are capable of rotating and tilting unwieldly jobs so that all welds can be made in the downhand position. With such equipment and electrodes of the E6020 or E6030 class, welding time can be reduced from 25 to 50 percent. In addition to saving in welding time, cleaning time is reduced, because these electrodes form an easily removable slag on the surface of the weld. Electrodes for flat and horizontal-fillet welding produce welds flat in contour and smooth surfaced; such welds are free of the ripples usually found on the surface of all-position electrode deposits.

There is unquestionable economy in flat-position welding for the manufacturer who has a volume of heavy welding. This volume may be made up of a number of relatively small assemblies requiring a fraction of a man-hour of welding on each. Frequently this type of piece can be positioned by hand for downhand welding. If this is not possible, it is doubtful that the saving in welding time, obtained by using flat-position electrodes, would justify the increased set-up time required for mounting the job in a welding positioner. Of course, the improved appearance and improved physical characteristics might even justify increased handling time on certain applications. However, the welding positioner will soon pay for itself when used to manipulate heavy fabricated steel sections requiring numerous man-hours of welding. The job that is too large or unwieldy for positioning can, at times, be broken into sub assemblies adaptable to the welding positioner.

When considering the use of high currents with downhand-position electrodes, it is worthwhile to consider again the type of welding machine. At times, magnetic arc blow, a characteristic due to the magnetic field surrounding the path of electric current, becomes exceedingly difficult to control when welding at high currents with a d.c. machine. When using an a.c. welder magnetic arc blow is practically negligible because the direction of current flow reverses 120 times a second in the standard 60-cycle machine.

An all-purpose electrode could be used on this job, but a better selection would be a downhand rod supplemented by one for fillet welding

Design, preparation, and fit of the joint are important in selecting an electrode because of the differences in the way the metal transfers across the arc. Metal from the class E6010 reverse-polarity electrode travels across the arc in a fine spray. A rod of this type, if used on a poorly-fit joint will tend to blow the metal through the crack and prevent fusion of the edges of parent metal; therefore, when using this rod it is necessary to have the edges fit closely or place a strip of metal behind the opening to stop the metal spray and cause it to build up a weld deposit.

Metal transfer from the class E6012 and E6013 electrodes is more globular. These electrodes will bridge across small gaps in a loose joint and make a satisfactory weld. Metal from all of the all-position electrodes must necessarily solidify rapidly so as to deposit a smooth weld when used in the vertical and overhead positions.

Class E6030 electrodes, though they have a somewhat globular metal transfer will not deposit well in a poorly-fit joint because the metal remains molten longer and tends to flow through the opening. It is because of the higher current densities used on these electrodes and the greater heat developed by them that they have higher deposition rates; but the same reasons prevent their use on poorly-fit work.

Selection of special and alloy electrodes, except hard-surfacing rods, is quite clearly determined by the metal to be welded. However, in this field of arc welding, there is not a great variety of rods available with different operating characteristics for each particular alloy. For example, there are only a few grades of nickel-chromium electrodes for welding the various grades of stainless steel. To arc-weld copper or copper alloys or bronze steel parts there is one general type of electrode. Likewise, for aluminum, there is one type of electrode.

Arc welding of cast-iron parts can be done with two classes of rod. The application of each class is clearly defined. One is required for welds that must be machined. The other is satisfactory where machining is unnecessary.

For hard-surfacing there are several electrodes ranging from inexpensive rods of high-carbon steel to costly alloy rods of nickel, chromium, and tungsten. Most of them are classified according to the Brinnel or Rockwell hardness of the deposited metal. However, hardness is not the only consideration in hard-surfacing. Toughness, freedom from checking, resistance to abrasion, and resistance to impact are important factors in surfacing applications. Each hard-surfacing job requires a careful study to determine what qualities are most important to obtain the best wear from the surfaced part.

More Cuts From Correct Set-Ups

BY ROY T. WISE, DEPUTY MACHINE TOOL CONTROLLER, OTTAWA, CANADA

Select the right tool, sharpen it correctly and then apply it properly. These are the ABC for maximum results from every tool

CUTTING TOOLS are a vital part of any production program. Without proper care, their usefulness is greatly handicapped. Previous articles presented some practical information on the selection and sharpening of cutting tools. The next consideration is their correct application.

In order to use the maximum productive capacity of milling machines and cutters, three fundamental factors must be observed:

1. The cutter must be correctly designed, manufactured, hardened and properly sharpened.
2. The cutter must run true so that each tooth in the cutter does its proportionate share of the work.
3. The correct spindle speed must be established in relation to the machinability of material to be milled, and feeds selected that will produce the proper chip thickness for each tooth.

Indicator Shows Runout

All of the effort of proper selection and sharpening can only be used to the fullest extent when the cutter runs true after it is assembled on the arbor. It is good practice to use a dial indicator to determine the amount of run-out of cutters after they are assembled on the arbor and before they are put to work. If they do run out, the indicator can be used to determine the cause. Some of the common causes of cutter runout are:

1. Arbor taper scored or bumped so that the arbor does not fit the taper in the milling machine spindle.
2. Spacing collars out of parallel on the ends.
3. Spacing collars scored on the ends; chips or dirt between the spacing collars.
4. Arbor hole in the cutter larger than the arbor.
5. Loose fitting or short driving keys.
6. Too vigorous use of the arbor nut wrench when tightening the arbor nut which will spring or stretch the arbor along the keyway side.
7. Diameter of arbor too small for the work to be done.
8. Arbor support bearing worn or loose.

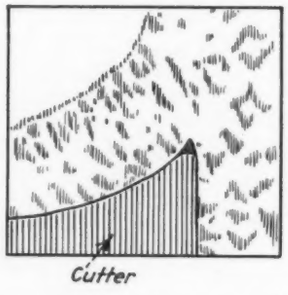
Cutters will run true after they are assembled on the milling machine arbor if the arbor is true, the taper is free from bumps or scores and if it correctly fits the spindle taper. Spacing collars should be inspected and if they are not parallel, or if they are scored on the ends, they should be properly ground.

Care should be taken when assembling the cutters and spacing collars on the arbor to see that there are no chips or dirt between the collars or cutters. The cutter arbor hole should not be more than 0.001 in. larger than the arbor, preferably less than 0.001 in.

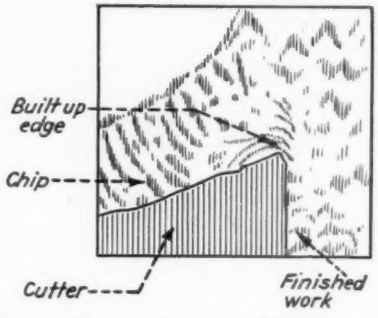
Arbors should have full-length permanent keys so that spacing collars and cutters will be assembled on the arbor in the same position. This will help to keep the cutter assembly running true. Too vigorous use of the arbor nut wrench will tend to stretch the arbor along the keyway side and make it run out. The key will drive the cutter if the nut is just normally tight.

If the arbor is sprung or runs out, it will soon wear the support bushing oblong so that it cannot properly fit the bearing. In other words, no amount of adjustment will keep the bearing permanently tight if the arbor does not run true.

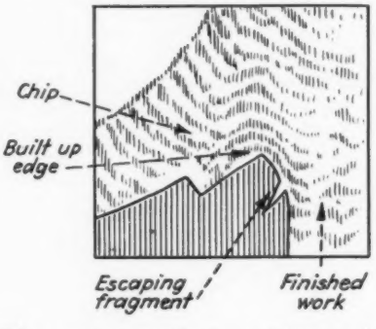
When all of these features are given careful consideration, the cutters and



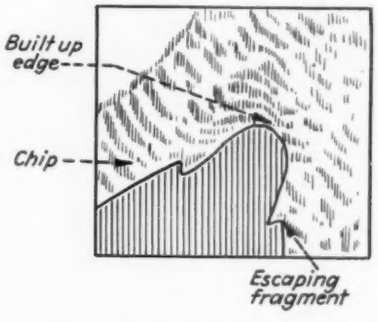
Note the small amount of build-up at the cutting edge. This is because the tool is very sharp. The chip is ruptured with little resistance



The cutter tooth is beginning to get dull. Note the increase in the amount of plastic flow ahead of the edge of the tool



The cutter tooth is getting quite dull. The amount of plastic flow ahead of the cutting edge is marked; it is beginning to leave behind it some escaping fragments



The tool is now at the point of failure. The radius has become large and the escaping fragments are big with plastic flow strongly marked

milling machines on which they are used will produce the maximum number of parts.

In these extracts selected from a large number of these records, the "old set-up" refers to conditions before the proper selection, sharpening and application of cutters. The "new set-up" is after giving attention to these features by making suitable changes.

Feeds and Speeds Changed

Speeds have been established to provide surface feed per minute in relation to the machinability of the component and the nature of the cut. In some cases speeds have been increased, and others decreased. Feeds have been changed to provide the proper chip thickness per tooth and improve the machining time so as to use more of the productive capacity of the milling machines. Arbor runout has been corrected, and permanent keys installed in the arbors.

An example of results from the selection of the right design of cutter is illustrated by the following operation before and after using the correct cutter for the work:

Component—Steel plate 0.200 x 4½ x 4⅝ in. long.

Operation—Mill edges—18 pieces held in fixture.

Machine—Brown and Sharpe No. 12 milling machine.

Cutter—Plain mill 4 x 4 in. radial teeth.

Speed—65 r.p.m. Feed, 2 in. per min.

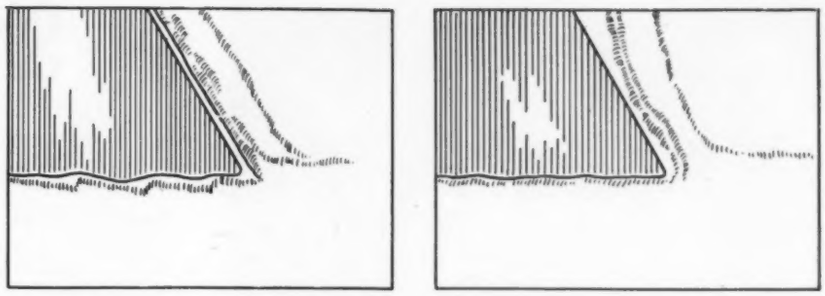
Pieces per grind: 54 average.

All conditions are now the same as above except that the cutter now in use is a 4 x 4 in. 52 deg. helical cutter, sharpened as recommended. The feed is now 7 in. per min., and the average is 504 pieces per grind.

A careful study of cutter design, speeds and feeds, and the proper sharpening and care of cutters will extend the useful life of the cutter and will also increase the productive capacity of the milling machine equipment.

Inspection Avoids Interruptions

In many plants the inspection of new cutters, before they are sent to stores or into departments for use, is under the supervision of a tool supervisor. All tools are inspected for Rockwell hardness, clearance back of the cutting edges, rake on the face of the teeth and general workmanship. This inspection has resulted to some extent in the elimination of setting up operations with tools which would not work and then having to break down the set-up and return the tools to the grinding room to be resharpened.



These sketches compare a tool cutting without lubrication to one used with lubricant. In the first instance (left) the escaping fragments are pronounced, but when the lubricant is applied, they disappear entirely

OLD SET-UP			NEW SET-UP		
Speed r.p.m.	Feed inches	Ave. Pcs. per grind	Speed r.p.m.	Feed inches	Ave. Pcs. per grind
36	1.1	50	50	3.1	400
Cutter diameter — 4½ in.		No. of teeth — 20	Type of milling — regular		

Remarks:
Checked arbor — Found 0.005 runout.
Installed short arbor and set of reground spacers with full length arbor key.

OLD SET-UP			NEW SET-UP		
Speed r.p.m.	Feed inches	Ave. Pcs. per grind	Speed r.p.m.	Feed inches	Ave. Pcs. per grind
65	1	30	47	2	200
Cutter diameter — 2 — 6 in. 1 — 3½ in.		No. of teeth — 24 12	Type of milling — regular		

Remarks:
Checked spotting face of fixture in six places for taper.
Found it to be out from 0.001 to 0.0005 from base of spotting face to top.
Found when table returned to starting position loaded, it caused the still cutters to scratch the finish on component. Moved the fixture ahead about 14 in. on table so as to enable operator to unload at one end and return rapid traverse with empty fixture.
This machine is Hydromatic.

OLD SET-UP			NEW SET-UP		
Speed r.p.m.	Feed inches	Ave. Pcs. per grind	Speed r.p.m.	Feed inches	Ave. Pcs. per grind
78	1¾	200	65	2 13/16	600
Cutter diameter — 3 in.		No. of teeth — 16	Type of milling — climb		

Remarks:
Changed this operation over to climb milling.
Check arbor, found runout 0.005.
Installed set of refaced spacers with full length key.

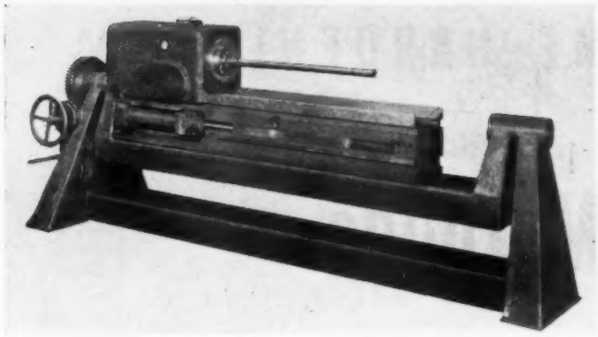
OLD SET-UP			NEW SET-UP		
Speed r.p.m.	Feed inches	Ave. Pcs. per grind	Speed r.p.m.	Feed inches	Ave. Pcs. per grind
75	1⅝	50–75	60	2½	200–250
Cutter diameter — 4 in.		No. of teeth — 20 staggered	Type of milling — climb		

Remarks:
No arbor bearing for this operation. Secured new bearing from stores. Installed set of ground spacers. Checked arbor — runout. 0.0003.
This operation was tried on climb cut with better results.
The fixture was designed for climb milling.

Shop Shots

Special grabs often pay for themselves many times over where a large number of parts of similar size and shape must be moved by overhead crane or hoist in the shop. The arrangement shown is used to move the main frame of a Farmall Tractor into position on an assembly line dolly. The frame for the next tractor is seen waiting at the end of its sub-assembly line. Final assembly operations on these tractors are performed at successive positions along the floor-level, slat-type conveyor on which the support dollies are mounted. At the other end of this conveyor, the assembled units pass through a spray painting booth and drying ovens, then hooks are fitted, wheels are mounted, and the tractors are removed to the final inspection area. Engines, other sub-assemblies and parts are delivered to the proper positions along the final assembly conveyor by overhead chain or floor-level roller conveyors. International Harvester Company.

Geared headstocks for engine and toolroom lathes are run in at top speeds on individual test stands specially designed to take the various heads for all sizes of standard lathes. In each case the motor is mounted on rails under the stand, and is connected to the headstock by flat or V belts. A constant stream of clean oil is supplied to each headstock from the large Sharpless centrifuge shown at the right. A flexible hose connects the oil supply line to the headstock. With oil flowing through the headstock at approximately 600 gal. per hr., there is no question as to the condition of the gears and bearings inside the heads when they are assembled to their beds. Three heads are shown mounted on run-in stands, while an empty stand is shown in the foreground. While the heads are being run in, the spindles are tested for accuracy, as can be seen at the headstock near the centrifuge. Special, adjustable bracket holds the dial indicator at different positions along the test mandrel so that any spindle run-out can be detected easily. Monarch Machine Tool Company.



Trunnion-type fixtures save much time in the bed scraping department, and more accurately scraped beds are obtained. Each can be adjusted by worm and worm wheel arrangement at the left to any convenient position so that surfaces on three sides of the lathe bed casting can be scraped. The fixture is arranged to take any standard lathe bed of the type made by this company, the bed being bolted to the swinging support arm as shown. By being able to turn the bed quickly and easily to bring either side in a horizontal position, the scraper can use his fixtures and gages conveniently. W. C. Lipe, Incorporated.

This combination welding and gas-cutting bench would be useful in almost any maintenance department or job welding shop. The top frame is made of $\frac{1}{4}$ x $2\frac{1}{2}$ x $2\frac{1}{2}$ in. steel angles with the horizontal legs turned in to support the cross members, which are $\frac{1}{2}$ x $2\frac{1}{4}$ in. steel plate cut to length so that they will slide down into $\frac{1}{2}$ in. slots formed by welding small angles inside the vertical legs of two opposite frame sides. Thus, the cross members are removable to suit conditions. The floor under the bench is covered with refractory brick as a protection from sparks and molten metal, while steel plates are placed around the brick to offer additional protection, and to keep the bricks in place. For welding operations, a removable steel plate, as shown, may be used to form a bench top. Hobart Brothers Company.

Fluorescent lights provide 35 foot-candles of light at the bench level in a recent addition to the plant. Scraping, assembly and packing operations all are accomplished in this area without individual or "spot" lighting. Glareless light is furnished in the daytime by a large area of windows which are blue tinted. The inner surface of the panes is sandblasted. There is no glare even under the brightest sunlight. The 100-watt fluorescent lights are placed on 10-ft. centers each way in this 60 x 190 ft. shop, except in the stockroom area where they are spaced above the center of each aisle. George Gorton Machine Company.

Spinning Methods

COMPILED BY J. G. MAGRATH, APPLIED ENGINEERING DEPARTMENT, AIR REDUCTION COMPANY

Flame hardening by spinning takes a more expensive set-up but where quantities justify it, the process pays for itself

FOR ROUND SURFACE hardening, where circular band spinning is possible, this procedure provides the best results. An even distribution of heat is directed to all the area, resulting in uniform depth and degree of hardness. There are no overlaps, either side or end zone, as in the case of the spiral or circular band methods. Where large scale production warrants the increased investment in apparatus, circular band spinning should be used.

Band spinning may be applied to small and medium diameter cylinders, shafts, journals and the like where narrow bands of complete circumferences are to be hardened. Such objects may be surface hardened by mounting on a spindle, lathe or other machine tool and spinning the part at a speed of about 1000 circumferential in. per min.

Tip Matches Hardened Surface

A water-cooled heating tip either without quench, or with quench operating separately under control, is employed, of a width equal, or nearly equal, to the width of the surface to be heated. After the surface has been raised above the critical temperature, the heating flames are withdrawn or extinguished, and the quench follows.

To obtain a case effect in circular band spinning, particularly on parts of small diameter, the heating time must be short. To accomplish this, a rough rule is to employ a gas flow equivalent to that of a standard flat flame-hardening tip per inch of diameter, at least. Thus to harden a 1-in. wide band on a 1-in. diameter shaft, employ at least one 1 in. wide tip, which delivers 80 cu. ft. of acetylene per hour. To harden a 2-in. wide band on a 1-in. diameter shaft, at least one 2-in. wide tip with 160 cu. ft. of acetylene delivery per hour. To harden a 1-in. wide band on a 2-in. diameter shaft, employ at least two 1-in. wide tips, diametrically opposed, each delivering 80 cu. ft. of acetylene per hour. With large shafts the time of heating necessary to provide the desired hardness will vary with the size of the shaft and the hardening properties of the steels. In general for shafts larger than 3 in., heating times of 30 secs. and longer can be tolerated. For small shafts the heating time must be strictly controlled. On a 1-in. shaft, the heating time must be under 10 secs. to secure a case effect. Longer heating times will heat the small diameter object through to the core.[4]

Diagramatic illustrations of circular band spinning as applied to outside surfaces are shown in Fig. 54. At the top is shown a small hollow part on which two water-cooled non-quenching tips are positioned diametrically opposite each other on a vertical axis, while two water-quench tubes are likewise opposed to each other on the horizontal axis. With quenches shut off, the flames heat the spinning part to the required temperature. At the expiration of this heating cycle the flames are extinguished and the quenches turned on the spinning part for a sufficiently long period to cool the part fully. The part is then removed from its spindle, and a new one is mounted on it.

Below (Fig. 54), the bearing of a small crankshaft is mounted upon a spindle, and the water-cooled non-quench heating tip as well as the water quench rings are each built in two segments. At the start the heating tip moves segments together automatically and about the bearing. At the end of

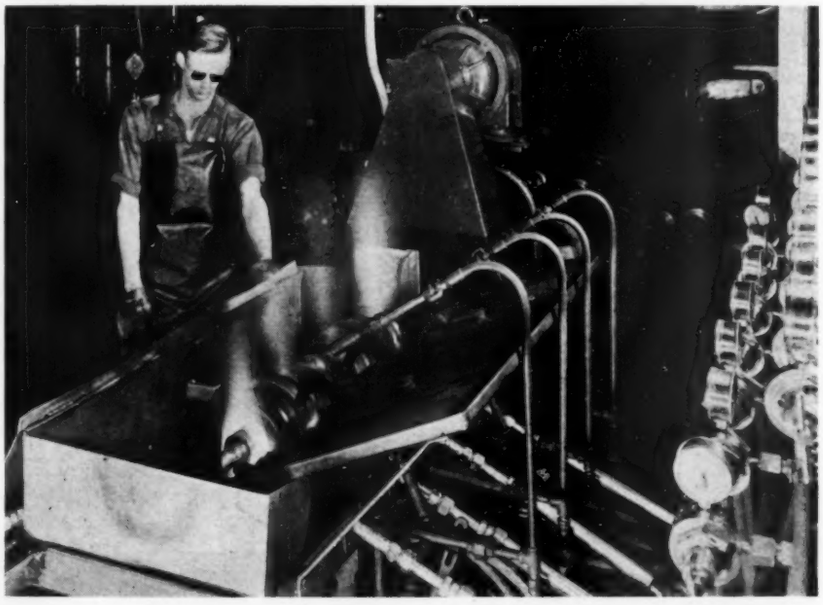


Fig. 55—*Four torches simultaneously heat the main bearings of this crankshaft; then the flames are extinguished and the bearings quenched*

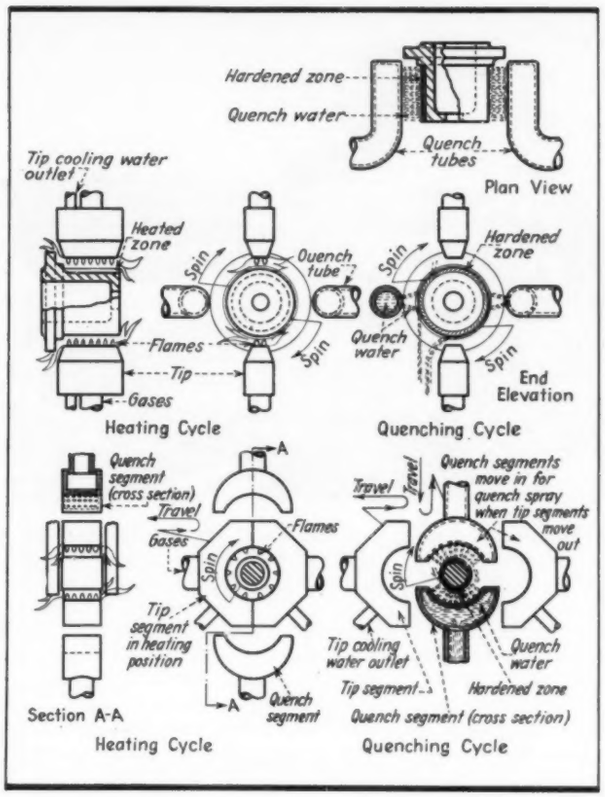


Fig. 54—*Small parts may be flame hardened on the outside by the circular band spinning method*

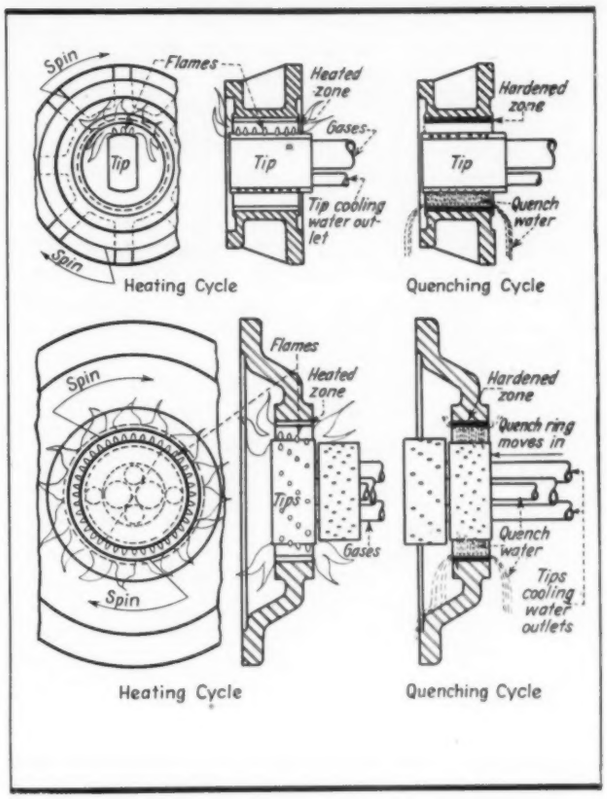


Fig. 56—*Circular band opening is also applied to inside circular surfaces of small parts*

the heating cycle, the heating tip segments move apart on their horizontal axis, and the water quench ring segments move in together on their vertical axis and apart again when the bearing is fully cooled so that the treated part can be removed and a new one inserted.

If the part is sufficiently small, an automatic device may be built to permit releasing the part from the spindle, or other spinning device, and dropping it into a quenching bath rather than using positioned quenches when mounted.

Used on Crankshafts

A multiple-torch arrangement for flame hardening the main bearings of automobile crankshafts by the circular band spinning method, is shown in Fig. 55. A cam movement was designed to light and extinguish the tips and control the quench cycle. A rebuilt lathe with tank and piping provides proper centering and spinning movement.

The bearings vary in width and consequently the time of heating is adjusted accordingly. The middle two are heated for 56 secs. The one toward the chuck end of the machine is heated for 48 secs., and the bearing at the front end is heated for 45 secs. An average surface hardness of 60 Rockwell C is obtained. Heating and quenching cycles are completed in a total 2 min. Production reached 175 crankshafts per 8 hr. period.

Circular band spinning may be employed for inside surfaces as well as diagrammatically detailed in Fig. 56. Smaller inside diameters of extended length (above) may be treated with integral heating and quenching tips, each phase being separately controllable. The part is spun and the internal surface is first heated to above the critical temperature. Then the flames are extinguished and the quench water is turned on. For larger inside diameters of short length (below) the procedure detailed is applicable. With the part spinning, the circular heating tip and quench ring unit is moved into position. The flames are positioned within the area for the heating cycle. On attaining the critical temperature, the flames are extinguished, and the quench ring is moved into position for the quenching cycle.

Progressive spinning to flame harden round objects of extended length is superior to either the circular band or spiral methods. The side or end zone overlaps are absent and the entire surface receives an even distribution of heat resulting in uniform depth and degree of hardness.

The method can be applied to all diameters where the number in production will warrant the investment in apparatus installation. As each inch of diameter hardening surface will require apparatus providing for 100 to 150 cu. ft. of acetylene per hour, multiple torches are the rule, each torch providing a maximum acetylene volume of 250 cu. ft. per hour, through one segment or tip.

Speed of Spinning

Outside diameters may be mounted on a spindle, lathe or other machine tool, horizontally or vertically, and spun at a speed of about 1,000 circumferential in. per min.; 2½ in. diameter at 125 r.p.m.; 6¼-in. diameter at 50 r.p.m. The water-cooled tips, either as units or as segments, surround the part for its complete circumference. Each tip unit or segment is supplied through its individual torch and regulator. This allows accurate and simplified adjustment, resulting in a complete peripheral balance of the heating flames.

The quench is generally provided by means of a separate quenching ring which closely trails the tips. Tips and quench ring travel parallel to the axis of the object at a speed ranging from 2 in. per min. for a hardness depth of $\frac{5}{16}$ in. to 6 in. per min. for $\frac{1}{16}$-in.

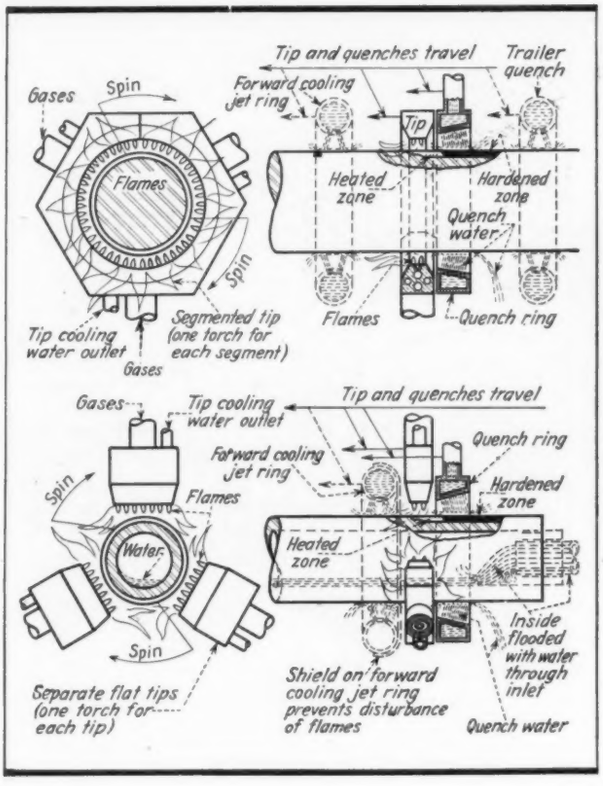


Fig. 57—*Long cylindrical surfaces lend themselves to flame hardening by the progressive spinning method*

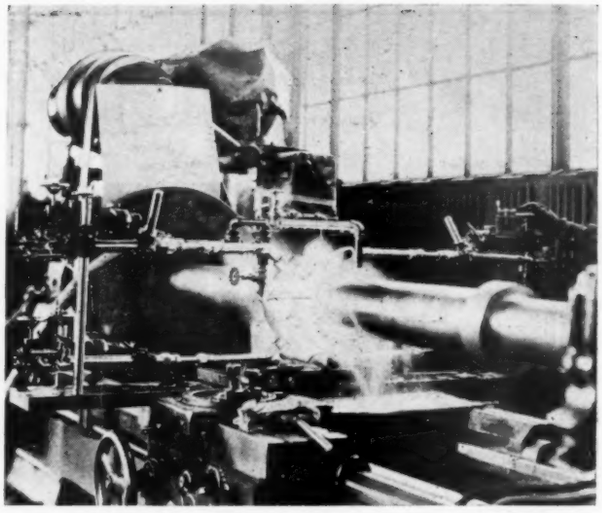


Fig. 58—*An 8-in. diameter shaft is flame hardened by progressive opening; four flat unit tips, used for heating, are followed by a water quench*

depth subject to variation with the thickness of the object heated.

It is frequently necessary to provide forward cooling jet rings or trailer quench rings, or both, when the object is hollow and the application is being made horizontally. The forward cooling jet ring will prevent heat withdrawal from the heating zone in advance of the flames and the trailer quench will prevent residual heat build-up behind the hardening zone, which might result in too great a drawing action upon the area previously hardened. When vertical application is made with the flame ring moving upward, the trailer quench only may be employed, using water. If a forward cooling jet ring is necessary on a vertical application, such may be supplied using compressed air. For hollow cylinders of larger size being flame hardened on the outside surface, an inside ring quench may be provided directly in line with the heating flames on the outside to prevent excessive heat penetration through the wall. On smaller diameter hollow cylinders the inside may be flooded with circulating water

In Fig. 57 the progressive spinning method as applied to outside surfaces is diagrammatically illustrated. Above, segmented tips are detailed in position followed by a ring quench. Forward cooling jet ring and trailer quench ring positions are indicated. Below, separate unit tips are shown spaced about a

Table XV—RELATION OF TIP SEGMENTS TO GAS CONSUMPTION ON SPUN ROUNDS — OUTSIDE AND INSIDE

Diameter of Round-in.	No. of Tip Segments and Torches	Acetylene Flow, cu. ft. per hr., for Each Segment	Total Acetylene Flow, cu. ft. per hr., for Assembled Tip
2	2	155	310
3	2	230	460
4	3	205	615
5	3	250	750
6	4	230	920
7	5	215	1075
8	5	240	1200
9	6	230	1380
10	6	250	1500
11	7	240	1680
12	7	250	1750
13	8	250	2000
14	9	240	2160
15	9	250	2250
16	10	240	2400
17	10	250	2500
18	11	250	2750
19	11	240	2880
20	12	250	3000
21	13	240	3120
22	13	250	3250
23	14	250	3500
24	14	250	3500

Based on approximately 150 cu. ft. acetylene flow per 1 in. diameter of round. Oxygen consumption, when employing a neutral flame, may be estimated by multiplying acetylene cubic feet by 1.1.

Table XVI—RELATION OF SEPARATE UNIT TIPS TO GAS CONSUMPTION ON OUTSIDE DIAMETERS OF SPUN ROUNDS

Diameter of Round-in.	No. of Tips and Torches	Width of Each Tip-In.	Acetylene Flow, cu. ft. per hr., for Each Tip	Total Acetylene Flow, cu. ft. per hr. for Grouped Tips
2	2	1½	120	240
	3	1¼	100	300
3	3	1¾	140	420
4	4	2	160	640
5	4	2¼	180	720
6	5	2¼	180	900
7	5	2½	200	1000
8	6	2½	200	1200
9	6	3	220	1320
10	7	3	220	1540
11	7	3½	235	1645
12	8	3½	235	1880
13	8	3½	235	1880
14	8	4	265	2120
15	9	4	265	2385
16	9	4	265	2385
17	10	4	265	2650
18	10	4	265	2650
19	11	4	265	2915
20	11	4	265	2915
21	12	4	265	3180
22	12	4	265	3180
23	13	4	265	3445
24	13	4	265	3445

Based on approximately 150 cu. ft. acetylene flow per 1 in. diameter of round. Oxygen consumptions, when employing a neutral flame, may be estimated by multiplying acetylene cubic feet by 1.1.

hollow object, followed by a quench ring. A forward cooling jet ring with a shield is shown in close position preceding the flames; if required, internal flooding is also indicated.

When employing separate unit tips, they must be equally spaced around the object. If unequally spaced, or if a segment is removed, a gap between the remaining segments is produced making the gas and water pressure during the hardening operation different from the areas covered by the tips and quench. This gap causes a violent disturbance which affects the quenching stream causing it to splash into the flames and on the heated surface, affecting the heating of the surface and the stability of the tip.[6]

The large shaft, in Fig. 58 horizontally mounted on a lathe, is flame hardened on its outside diameter employing the progressive spinning method. Four separate unit tips, are providing heat, followed by a quench ring. Each tip is controlled by a separate torch which is accurately positioned and held with adjusting arm mechanisms providing horizontal and vertical movement.

A vertical flame-hardening machine is illustrated in Fig. 59. In this instance a segmented outside heating tip is supplied with gases through four torches and closely followed by a quench ring. The object is spun in its vertical position while the flames, starting at the bottom, move upward for its full length at a proper speed to result in the desired depth. All cycles and movements are performed automatically with this type of machine.

Two set-ups, diagrammatically detailed in Fig. 60, illustrate progressive spinning on inside surfaces. A large diameter is shown above where the part, held in a chuck or spider, is spun at an inside circumferential speed of about 1000 in. per min. The assembled compartment tip, with gas supplied by four torches and followed by an inside ring quench, travels through the inside at the proper speed to provide the desired hardness depth. Liners, sleeves and cylinders may be surface hardened in this manner in either vertical or horizontal set-ups.

Smaller diameter objects of extended length may be flame hardened (Fig. 60 below) employing a water-cooled heating and quenching tip mounted on a long rigid extension. An outside ring quench with quench streams directly opposed to the flames on the inside may be used to prevent complete heat penetration through thin wall sections. The object is horizontally mounted on a lathe and held in position with readily movable steadyrests. The torch may be mounted on the cross-feed and forwardly fed into the inside of the object.

Table XV provides the number of tip segments or compartments and gas consumption when segment or compartment tips are employed. Table XVI furnishes the number and size of tips required when separate unit tips are used, as well as gas consumption for each combination of tips.

The next installment of this series will appear in an early number.

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6. Report of Stephen Smith, Sub-Committee on Flame Hardening, American Society for Metals, January 16, 1939.

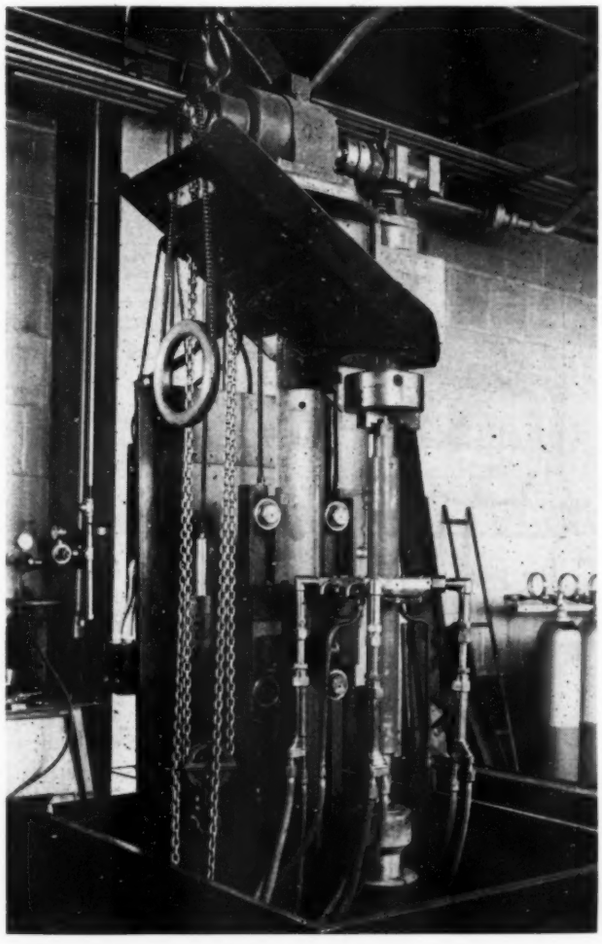
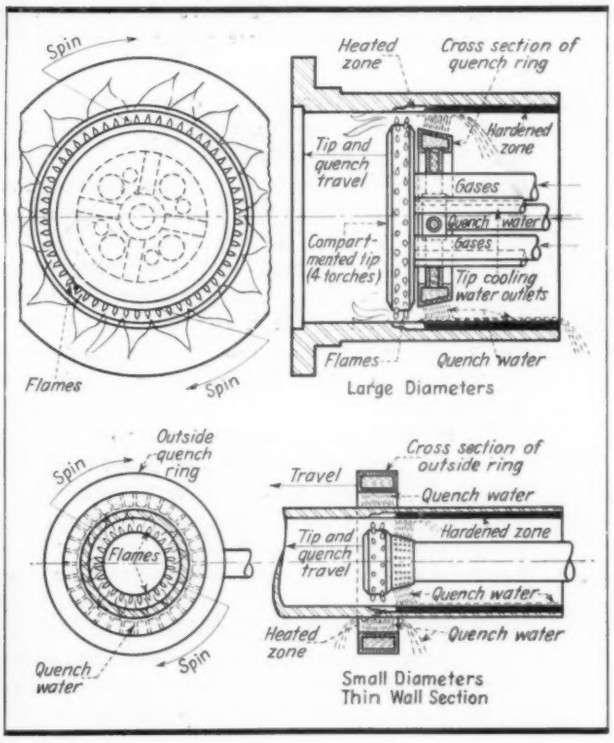


Fig. 59—*This vertical machine is fitted for surface hardening by progressive spinning; it may also be used for the progressive circular band and band spinning methods*

Fig. 60—*Long inside cylindrical surfaces may be hardened by progressive spinning*

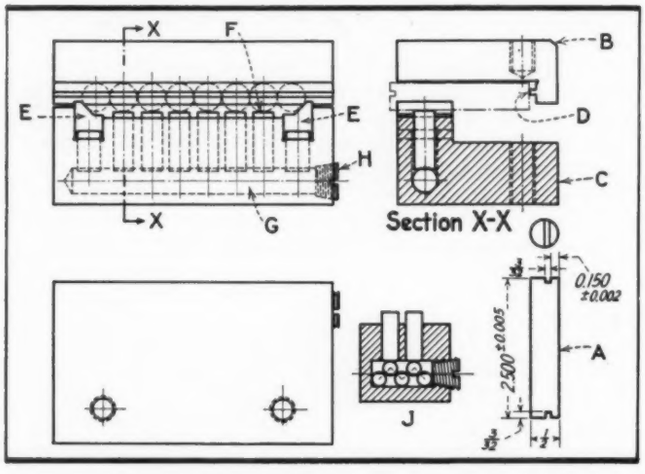


IDEAS FROM PRACTICAL MEN

Equalizing Fixture for Multiple Work

BY DON BAKER

In manufacturing parts such as shown at *A* in the drawing where tolerance on the slot is given from one side of the piece, it is sometimes difficult to hold a number of pieces in the fixture at one time. The type of fixture usually employed consists of a number of movable V-blocks which can be clamped together.



An equalizing fixture exerts uniform pressure on all the work pieces. The latter can be placed close together, thereby decreasing milling time

Such a fixture is expensive to make and much time is wasted in milling "air," since the parts must be separated a distance equal to the thickness of the V-blocks.

The fixture described here overcomes this objection. It consists of the stationary jaw *B* and a movable jaw *C* containing a series of equalizing plungers. The jaws are made of machine steel, pack hardened and ground where necessary. The stationary jaw, besides locating the piece in the normal way, has a key *D* over which the first slot milled is placed, thus locating the work in the correct position for milling the slot at the opposite end.

The movable jaw *C* contains the plungers *E* and *F*, which are hardened, ground and lapped on their diameters, and are a sliding fit in lapped holes in the jaw. Directly behind the holes in which these plungers fit is the cross hole *G* which, in one of the fixtures I am using, is filled with beeswax and closed at its open end with a pipe plug. Plungers *E* have T-shaped heads which are made a sliding fit in ground openings in the jaw. These T-heads have angular surfaces which contact the work and act both to square up the parts and hold them in position.

When the vise is closed, the plungers contact the work and equal pressure is brought to bear on all pieces, regardless of any variation in diameters, through flow of the beeswax behind the plungers. Steel balls may be preferred by some users instead of the beeswax. The principles on this equalizing fixture may be used on a variety of jobs where differences of diameters of the work pieces make it difficult to exert equal holding pressure on all of them.

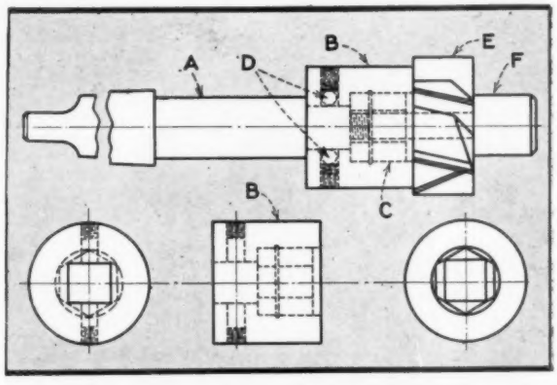
Equalizing pressure by using hardened steel balls behind two or more plungers is shown at *J*. Pressure on either plunger will be transmitted to the other through movement or crowding action of the balls in the direction of the dashed lines. It is best to use a great number of small balls; the usual size is $\frac{1}{8}$ in.

Adapter for Internal Spotfacing

BY TED VAN OOSTERHOUT

Spotfacing an internal boss in a bevel-gear box was always a problem in our shop until we made the adapter shown in the drawing. It is used on a standard hexagon-drive spotfacer which we had on hand.

The shank *A* was made from tool steel. After turning and facing, a $\frac{11}{16}$-in. hole was bored in the



The pilot, counterbore and adapter of this spotfacer is driven by the square-ended shank. Spring retainers hold the assembly during the machining of a boss at right angles to the adapter

shank and counterbored $\frac{15}{16}$-in. diameter and 1 in. deep. The square and hexagon openings were then worked in the block to fit the square on the shank, the hexagon nut *C* and the hexagon drive of the counterbore. A small groove was turned to receive a spring retaining ring for nut *C*. Balls *D* act as friction pads on the square shank and are backed by a spring and setscrew.

Assembling the parts, nut *C* is held in place by the spring retainer ring. Adapter *B* and counterbore *E* are held together by pilot *F* and nut *C*.

The unit *B, E, F* is placed in working position through the bear-box opening with pilot *F* in the lower shaft hole. The shank *A*, inserted in the drill-press spindle, is lowered through the upper shaft hole and engages the square hole in the adapter *B*, making a rigid unit. Balls *D* prevent the adapter from dropping off the shank but permits easy removal. Shaft *A* and pilot *F*, being made a running fit in the shaft holes. The boss is machined at right angles to the center line of the hole.

This adapter with slight modifications could be used on pin- or ball-drive counterbores.

Drill Jig for Synthane Bushings

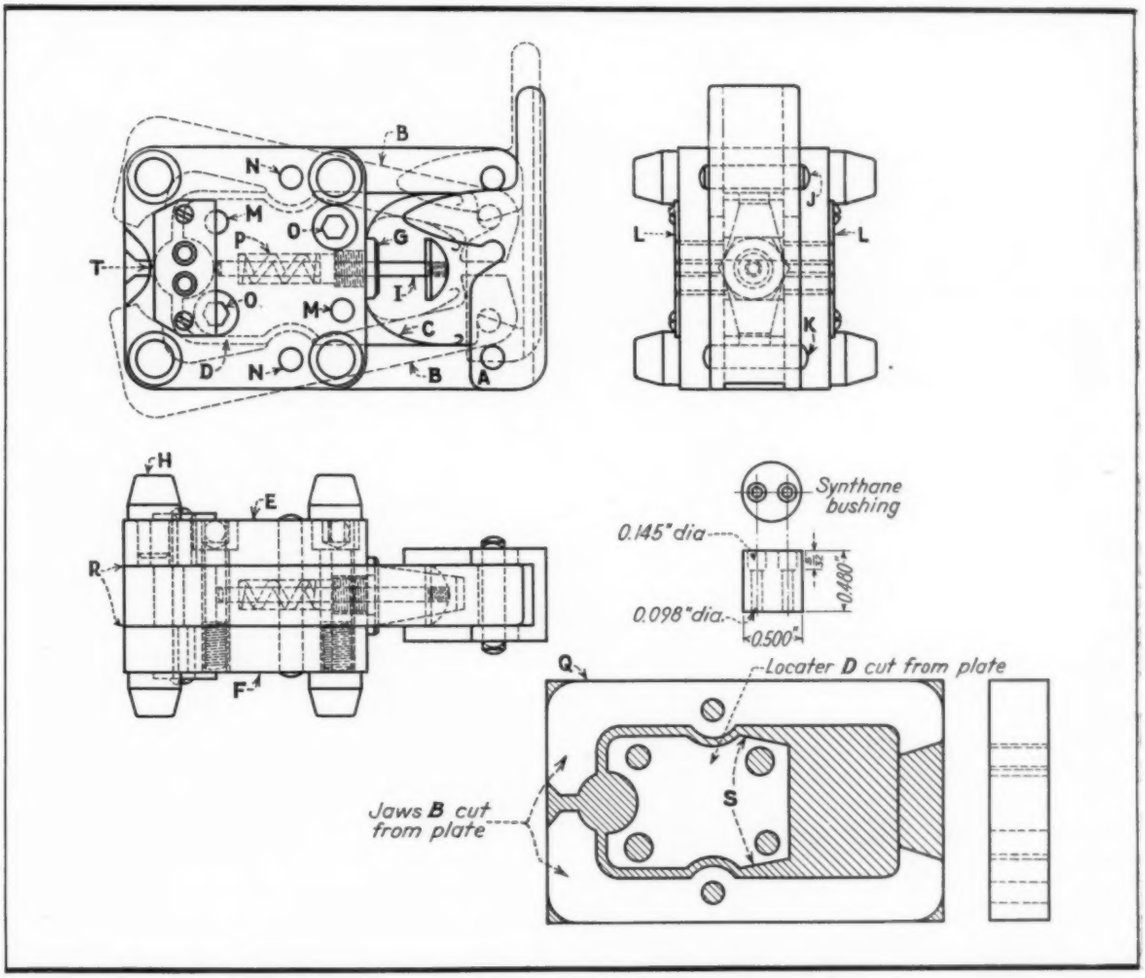
BY DANIEL I. KRAUSS

We had a large number of synthane bushings to drill with stepped holes as shown in the drawing. This was done accurately with the jig illustrated; the dashed lines indicate its open or loading position. Of particular note is the combination cam and lock *A* which clamps the bushing while drilling and also locks jaws *B* in the open position when loading, unloading and cleaning. Flat spring *C* normally holds jaws *B* in the closed position. Plate *D* separates the top and bottom plates *E* and *F*, and provides the nest for the bushing.

Top and bottom plates *E* and *F*, clamping jaws *B*, locating plate *D*, cam *A* and knockout retaining nut *G* are of cold-rolled steel. Feet *H*, knockout *I*, and cam pins *J* and *K* are of drill rod. The guard plates *L* are ground stock. The dowels *M* and fulcrum pins *N* are standard dowels. The two standard socket capscrews *O* hold the jig together, and the compression spring *P* holds the knockout in the position shown.

Top and bottom plates *E* and *F* are $\frac{3}{8}$ x 2 x 2 in. The cam lock is made from $\frac{3}{4}$x1$\frac{1}{4}$x2$\frac{1}{2}$-in. stock. Standard finish sizes of stock were chosen to minimize machining.

When making the jig, top and bottom plates *E* and *F* were finished ground on both sides. Plate *Q*, from which the jaws *B* and positioning plate *D* were made,



Stepped holes in synthane bushings, are drilled accurately in this jig. After the large holes are finished, the jig is turned over for drilling the smaller holes. Releasing the cam operates the knockout pin and opens the clamping jaws, thus removing the finished bushing

was first finish ground to the proper thickness, after which it was laid out as shown by cross hatching. The bushing hole was bored to size and the screw, dowel and fulcrum pin holes were drilled with undersize drills. Plate *Q* and top plate *E* were clamped together and the holes in *Q* transferred to plate *E*, after which the bottom plate was added and the holes finished to size by drilling and reaming through the assembly. This assured accurate alinement of all these parts with the locating plate *D* that positions the synthane bushing for drilling. The bottom plate was tapped to receive the capscrews *O*.

The drill-bushing holes were then bored, as follows: Plate *Q* was first doweled and clamped to bottom plate *F*, which was soldered to a parallel plate and clamped to the machine table. The jig was squared with the table travel and the bushing hole indicated. The proper table movements were made and the holes in the bottom plate bored. The top plate was then doweled to plate *Q* and the top holes were bored.

With the holes bored and checked, the jig was taken apart and plate *Q* contour sawed to the lay-out shown by cross hatching. Jaws *B* and locating plate *D* were thus made from the plate used to aline and machine the jig proper. The jaws were case-hardened and ground to be a sliding fit between plates *E* and *F*. Holes for the feet *H* were then drilled and reamed, and the feet pressed in place. The drill bushings were pressed into the top and bottom plates until their ends were flush with the surfaces *R*. The locating block *D* was finished to layout, drilled and tapped for the knockout and retaining nut, and then assembled to the plates *E* and *F*. The bevel edges *S* limit and equalize the opening of the jaws *B*.

Flat spring *C* is approximately 0.008 in. thick and is held in place by retaining nut *G*. Cam *A* is of channel section, having cam faces on both sides of the jaws, which contact locking pin *J*. The cam is case-hardened after it has been fitted. Top plate *E* was cut out as shown at *T* to facilitate loading. The mechanical advantage of the clamping jaws and the cam supply ample holding pressure when drilling the synthane bushings.

In service, the synthane bushing is loaded and clamped in position, and the large holes drilled to a predetermined depth. The jig is then turned over and the smaller holes drilled, allowing the drill to break into the larger ones. The cam is then unlocked, opening the jaws and releasing the knockout which pushes the bushing from the jig, thus completing the cycle.

Level Seats Reduce Broken Spring Saddles

BY ARTHUR HAVENS

Railroads often have an epidemic of cracked and broken locomotive spring saddles, which usually can be traced to uneven saddle seats on the top of the driving wheel boxes. The uneven seats are the result of wear caused by the heavy loads sustained by these saddles, which move under spring action while the locomotive is in service. Furthermore, the wear is greatest at the outside or wheel side of the boxes.

Unless these seats are leveled when repairs are made to the spring rigging, the saddles will not be square with the box, and movement of the rigging under service conditions places undue and concentrated strain on them. Breakage is the inevitable result.

All too often locomotive mechanics compensate for this wear by inserting pieces of steel plate under the saddle seats. This does little good because the pieces soon pound out or work down, leaving the saddle to weave and twist, and soon develop cracks.

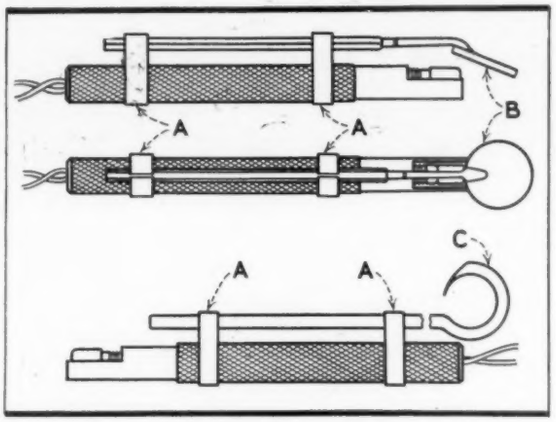
The best and permanent repair is to weld the worn pockets or seats at the top of the driving boxes to a standard size. Numerous gages may be made to check these seats and keep them uniform. Similar repairs can be made to the base of the saddles.

Machinist's Peep Light Uses Dental Mirror

BY C. F. FITZ

In tool and die work one quite frequently has a job that requires light at a certain point which cannot be secured with the standard light fixtures available in shops today. To meet this need we made the peep light shown in the drawing.

The body proper is made from steel tubing having its outside knurled to form a hand grip. One end has



Peep lights for illuminating inaccessible points on machine work can be made out of tubing. A small mirror is the reflector

a miniature socket soldered in place and the end cut as shown to form a reflector. Two clips *A*, made from flat spring stock, are used to attach a dental mirror *B* to the light for directing the light at a definite point or for attaching a handle *C* to it; the latter permits one to drop the light in a deep hole for inspection.

Electricity for the light is supplied from dry cells or from a doorbell transformer. This light has worked out so well that we have practically every machine in the shop equipped with it.

Punch-press set-ups with cast dies use hard-rubber stripper pads around the dies

Lugs or holes are cast in the dies for attachment to the ram by goose-neck or T-clamps

VEGA APPLIES CAST DIES

Lower tooling costs, rapid die production, cheaper machine set-ups and greater output of blanked and formed shapes result from the use of Kirksite punch-press dies for airplane parts

BY JAMES A. HARRIS
Foreman of Hammer, Foundry and Press Department
Vega Airplane Company

CAST KIRKSITE DIES have demonstrated many advantages over continental or tool-steel dies for blanking and forming aircraft parts in the punch press. The Vega Airplane Company has now adopted them for a large portion of its punch-press production.

Kirksite is an alloy of zinc with aluminum, copper and magnesium developed to replace the zinc dies used widely for drop-hammer forming of aircraft parts. Until recently it had never been tried for punch-press operations. The use of cast dies speeds up the production of dies, and cuts the cost, over the method of machining dies from tool steel.

The development of the Kirksite die process is especially timely as Vega is undertaking large scale

VEGA APPLIES CAST DIES

production of the Boeing "Flying Fortress" bomber under the "B. V. D." (Boeing-Vega-Douglas) plan.

To appraise properly the importance of Kirksite cast dies it is well to review the record of aircraft metal-forming methods. Sheet duralumin parts were originally formed by hand, bumping them over hardwood forms. Greater production brought about the development of the drop hammer, with zinc female dies and lead punches. Kirksite alloy has been widely adopted in place of the zinc drop-hammer die. In the Guerin process one die is completely eliminated by a thick rubber blanket which is forced against the remaining die in a hydraulic press. This die had been of various materials, such as steel, masonite or zinc, the selection of which depends on the operation. Now, with the rush to achieve quantity production of airplanes, manufacturers have turned to the punch press for much of their sheet-metal blanking and forming.

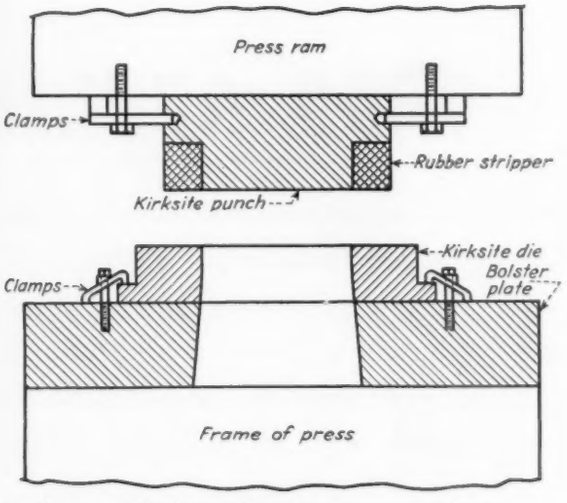
Saving in die costs is illustrated by the record of the first 17 cast Kirksite dies made by the Vega Airplane Company. Although die production technique has not yet been worked out so as to take complete advantage of possible economies, these 17 dies were made for an average labor time of 30 man-hours per die. This compares with a labor time of about 100 man-hours for identical dies machined from tool steel. It is estimated that in the future the time on the Kirksite dies of this type can be cut to about 12 or 13 man-hours. The actual over-all time required to produce a cast Kirksite die may be as low as eight hours, compared with three or four days for tool steel dies.

Cast Dies Are Less Costly

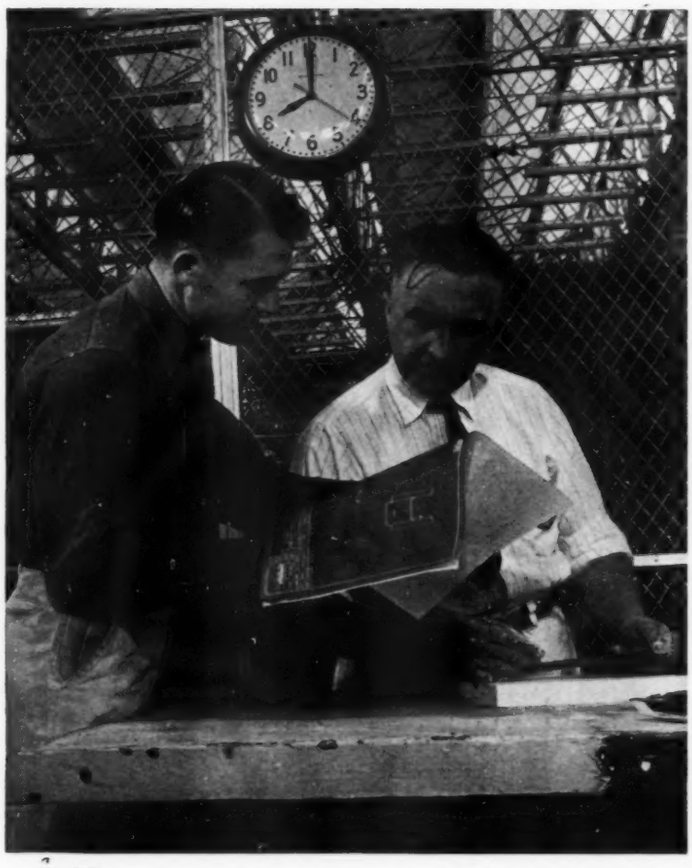
Time saved in production is illustrated by one punch-press run which produced 310 aluminum-alloy switch-box covers in 1½ hrs., compared with a drop-hammer time on this part of 15 min. per unit, or four parts per hour. Limited runs of parts which had formerly been made on the drop hammer, because of the prohibitive costs of steel dies for punch-press work, will now be shifted to the punch press.

Other economies result from use of the cast Kirksite dies. The material itself costs only $10.75 per 100 lb. against $33 per 100 lb. for tool steel. There

Dural 24SO and 24ST up to 1/8 in. thick and stainless steel of lighter gage can be blanked and formed successfully with these dies. Compound dies have been made for simultaneous blanking and forming



In this cast blanking die set-up on a punch press, a rubber block is used in place of a stripper plate. The dies are cast in sand molds—very little machining is required to finish them

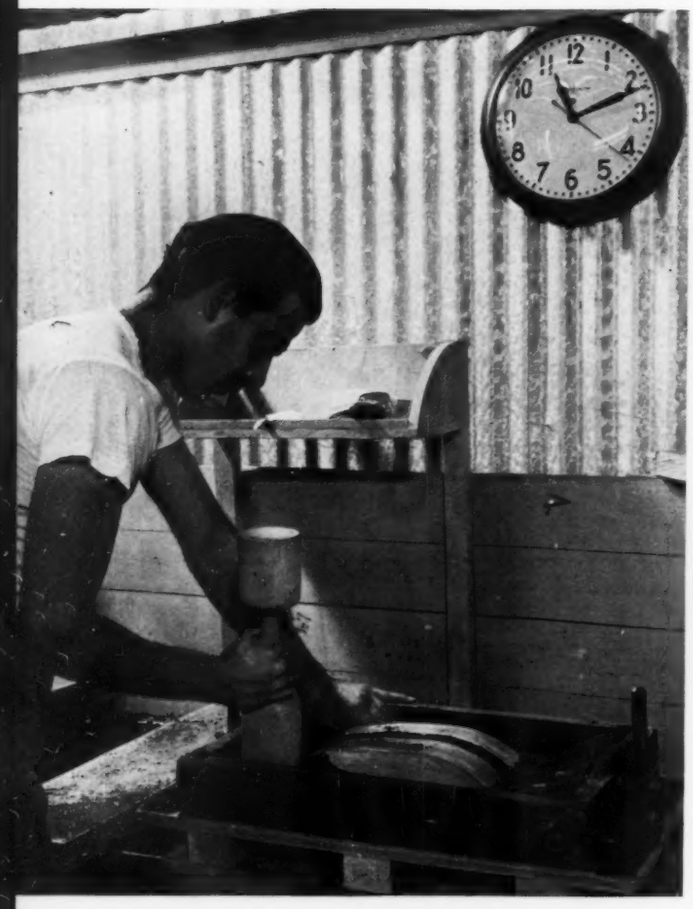


8:00 a.m.— Part drawing is supplied to the pattern shop for making plaster-of-paris patterns of the die

9:30 a.m.— Less than two hours later, the plaster-of-paris die nears completion

DIES— From Blueprint to Production in 8 Hours

11:02 a.m.— Pattern maker letters part number on the completed pattern



11:10 a.m.—Foundry molder prepares sand mold from the pattern

12:20 p.m.—Kirksite is poured into the mold to form the punch-press die

is almost complete salvage of all Kirksite dies as they can be remelted when worn out, but the tool-steel dies can not be salvaged other than as scrap metal for about 2 cents per lb.

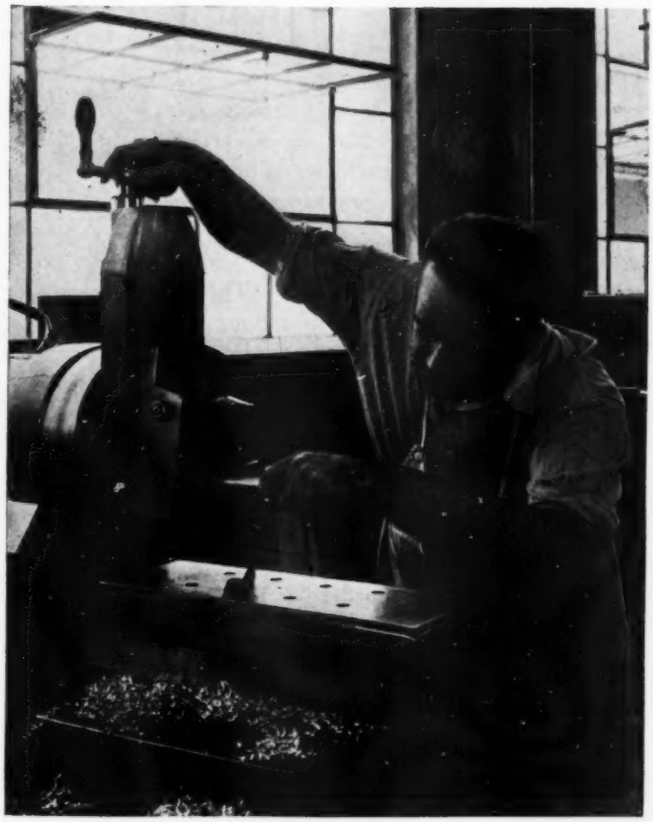
Another marked difference between the Kirksite dies and steel dies is that attachment ledges can be cast into the body of the former, permitting it to be attached to the press by simple goose-neck or T-clamps. This eliminates the expensive die sets required with most steel-die set-ups. For a stripper plate on Kirksite blanking dies, a simple hard-rubber stripping pad is mounted around the die and has proved highly satisfactory.

For both forming and blanking it has been found possible to work dural 24SO and 24ST up to 0.125 in., and stainless steel of lighter gage has been both formed successfully. Compound dies have been developed satisfactorily for simultaneous forming and blanking. In some respects Kirksite dies are superior to steel for blanking operations. The tendency of the Kirksite to flow towards the shearing edge under pressure of the blanking operation cause the die to sharpen itself. After blanking 1,100 parts on a Kirksite die we found less burr on the parts than at the start of the run, while the die dimensions were within 0.002 in. of the original specification.

Production of cast Kirksite dies is simple and follows a procedure well established in drop-hammer work. A pattern is made of wood or plaster and from this a sand mold is taken. The Kirksite is cast directly in this mold and little machining is required to finish the die. Although in drop-hammer work the punch is cast of lead, poured in the Kirksite female die, punch-press dies are both of Kirksite. Since Kirksite has a relatively high shrinkage the punch die is usually cast first, coated with a protecting material and the female poured die around it. In this case the shrinkage is inward and it is possible to allow for it by varying the thickness of the coating used on the punch die. In some cases both dies are made from patterns.

Machining on blanking dies usually consists of a

VEGA APPLIES CAST DIES



3:07 p.m.—The base of the die is machined for precision mounting in the press

4:00 p.m.—Punch-press operator clamps the die in place on his machine

4:07 p.m.—Parts are produced on the press 8 hr. 7 min. after the drawing of the piece was first delivered to the pattern shop

light cut across the face of the die to produce sharp edges for blanking. The die can usually be restored after a production run by taking another light cut across the face of die and punch.

Kirksite is a patented alloy of zinc, aluminum, copper and magnesium which is lighter than zinc, has several times the impact strength, much greater Brinell hardness and six or seven times the tensile strength. The harder surface of Kirksite results in longer die life. When damages do occur or worn edges are to be repaired, it is possible to build them up by welding with a Kirksite rod. This cannot be done with zinc.

Maximum speed is demanded by plane manufacturers when making changes in old designs, or in placing new designs in production. The flexibility in changing old designs of blanked and stamped parts, as well as speeding production of new designs, are achieved to a high degree with Kirksite dies. The illustrations, showing the making of one die in eight hours, exemplifies this. Vega is duplicating this job.

MENASCO AIDS AIR CORPS

Menasco's new plant produces low-horsepower air-cooled engines of in-line inverted design. Precision machining is reflected in performance records made by planes used for training United States and Canadian pilots

By JOSEPH E. BABCOCK
Plant Manager, Menasco Manufacturing Company

HUNDREDS OF MENASCO ENGINES have been built for the training planes of the United States, Canada and various foreign countries. These engines are relatively small—the D4B "Pirate" trainer engine has a rating of 160 hp. Their importance to national defense is measured by the need for thousands of military pilots, who must first be trained in small planes.

The Menasco engine is an inverted air-cooled unit of four or six inline cylinders with the crankcase at the top. It is similar in general arrangement to an automobile engine, except that oil is carried in an external tank, fed to the engine parts under pressure, then scavenged from a shallow sump along the cylinder skirts.

As on an automobile engine, the two major parts are the crankcase and crankshaft. The Menasco engine uses a crankcase that is split along the crankshaft centerline. The upper case acts only as a cover, while the lower part is the structural member to which the cylinders are mounted, and which carries the crankshaft. The accessory drives are grouped in an auxiliary case at the rear of the main crankcase.

Each cylinder is mounted separately, because of air-cooling feature which calls for generous finning. Cylinders are finish machined from rough steel ring forgings, while cylinder heads are aluminum alloy castings. Each cylinder assembly is held to the crankcase by four long steel studs extending from the crankcase down through the cylinder head.

Engines at the Menasco plant are assembled on dollies which can be moved from station to station. The D4-87 engine has a 6:1 compression ratio and a one-minute take-off rating of 134 hp. at 2,260 rpm. In flight, the rating is 125 hp. at 2,175 rpm.

Cylinder heads, valves, tappets, valve inserts and seats and auxiliary drive accessories, as well as other component parts of Menasco engines are all made in Menasco's machine shop. Parts are stacked on portable racks to speed handling from one department to another

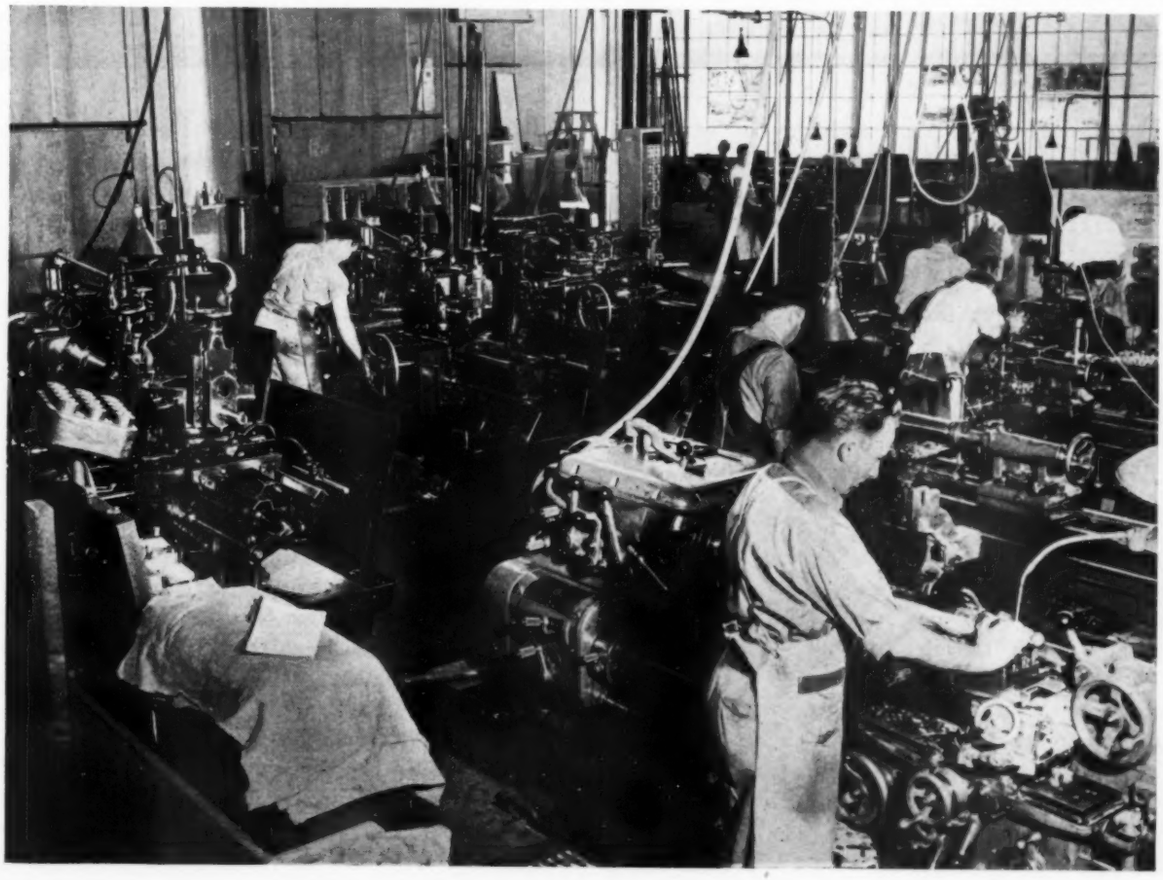
TRAINING

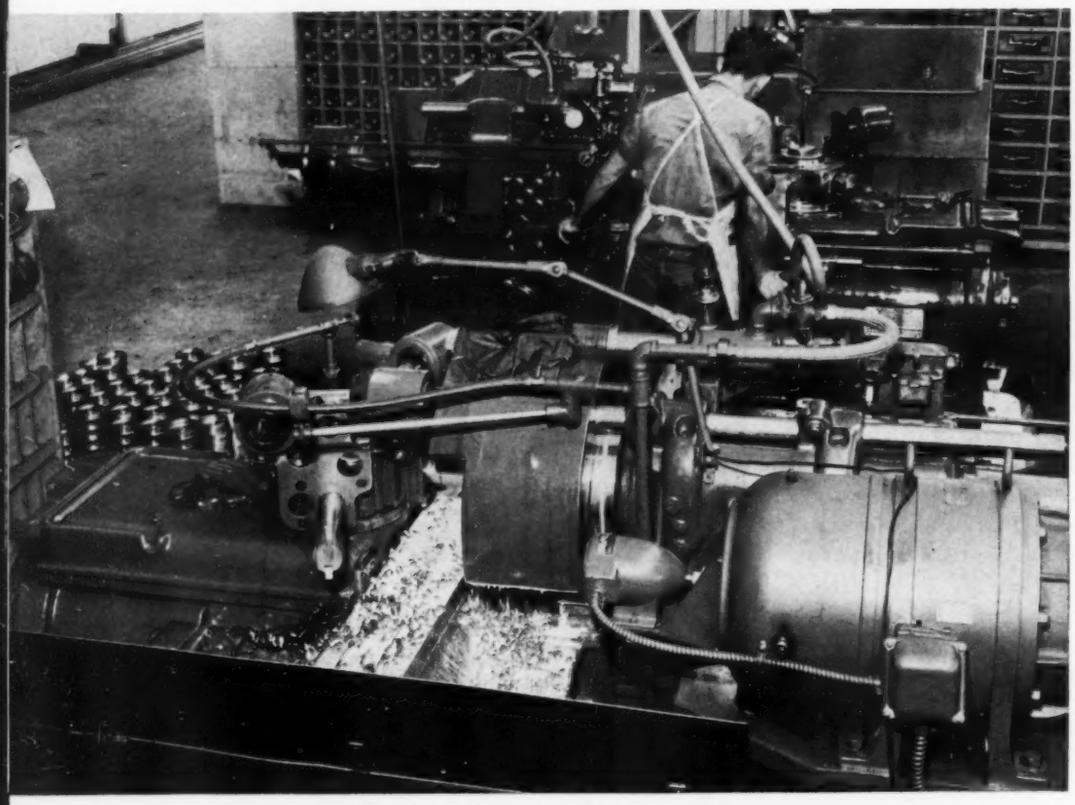
The engine was developed in connection with air racing and proved successful, winning many championships. But it was not until the company was reorganized late in 1939, under the leadership of A. E. Shelton, president, that it was placed in a position to meet increasing demands for defense production. During 1940 a new engine factory was built and equipped. It is a conventional, steel frame building with concrete floor and saw-tooth roof.

Machines have been arranged to provide efficient flow of the work. All parts are carried on special portable racks which serve both as a work rack for the machine operators and as a means of moving parts from one operation to the next. Broad aisles run throughout the plant; material handling, under these conditions, is not a problem. The company operates its own aluminum foundry and produces much of its own aluminum castings, as well as a considerable volume of castings for other aircraft builders. The plant includes a strut division devoted to the production of aircraft landing gear struts for plane manufacturers.

The Menasco plant has been fully equipped with

Aluminum-alloy crankcases are normalized and enameled before machining is started. Enameling seals the porous aluminum and prevents loading with machine oil, which would make finish painting difficult. Close tolerances are held to assure interchangeability





Cylinder barrels are rough and finished machined, except finning, on Potter & Johnston automatic turret lathes. One machinist operates two lathes

modern machine tools, and a staff of machinists has been trained in the exacting work of aircraft engine building. While quantity production is the current need, a high standard of quality has been maintained. Minimum tolerances held on various parts will serve as an example of this: piston pin bore in piston, 0.0005 in.; crankshaft thrust-bearing diameter, ground finish, 0.0005 in.; all line bearings must not run out more than 0.002 in. full indicator reading; diameter of all bearings is kept within 0.0005 in. out-of-round; crankcase-cover and cylinder-flange faces on the crankcase are held to ± 0.001 in.; all crankcase dowel holes to ± 0.001 in. center distance; crankcase bushings to 0.0005 in.; crankshaft main bearings are line reamed to 0.0005 in.

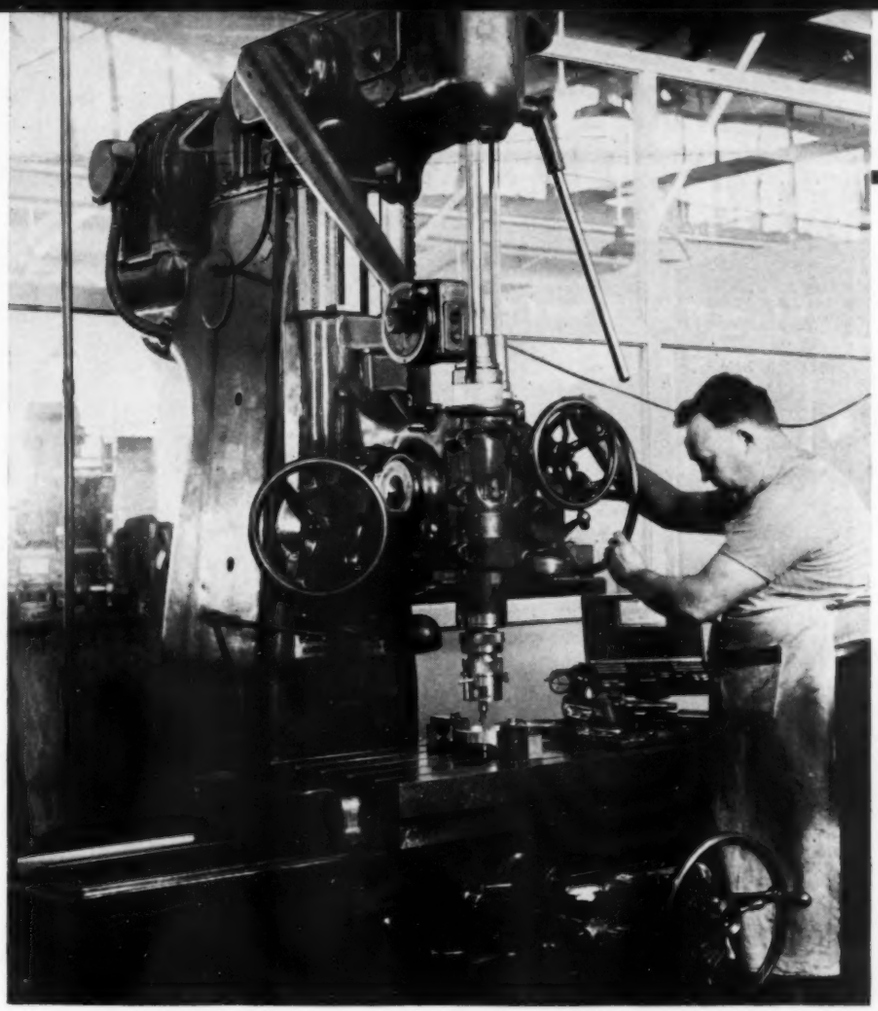
Crankshafts are dynamically and statically balanced to 0.05 ounce-inch on a Tinius Olsen balancing machine and are aligned to 0.001 in. All reciprocating parts are carefully matched and balanced: X-ray and Magnaflux methods are used to inspect all major parts for hidden flaws.

Aluminum-alloy crankcases are cast to Menasco specifications, normalized to relieve internal stresses and then shipped to the factory. The first operation is to apply a prime coat of red enamel on the inside and blue enamel on the outside of the entire crankcase casing. This enamel is then baked on to seal the porous aluminum material before admitting it to the machine shop, and to prevent it from "loading" with machine oil which would make later finish painting very difficult. Also, there is some advantage from a machining standpoint in having parts painted prior to entering the shop—it is easier to work with and inspect a painted part. A finish coat of baked enamel is applied externally after completion of all machining operations.

The first machine operation on the crankcase is the milling of cylinder base pads in a Becker vertical mill. These pads are all in the same plane, which makes this a continuous feed milling operation. A surplus of 0.030 in. stock is left on the pads for later finish; also, it provides protection for these surfaces during subsequent handling. Next, the parting line is milled to finish size, being held flat to a tolerance of 0.003 in. flat at any point.

A templet is then used to locate and drill two dowel holes in a Hammond radial drill. Thereafter the plane of the parting line and these dowel holes are used for reference in other machining operations.

Main-bearing stud holes are drilled and tapped,



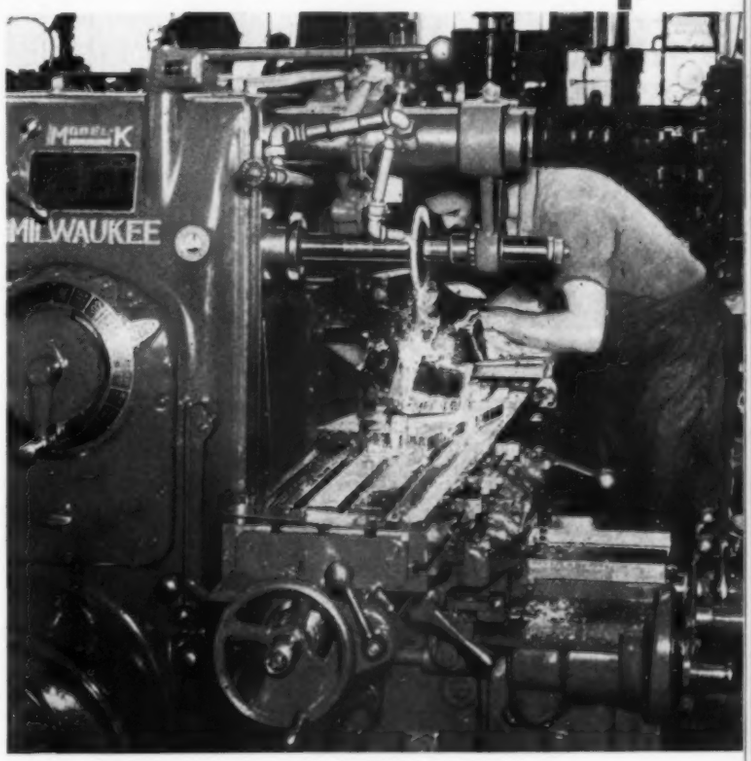
This Pratt & Whitney jig borer in the toolroom helps Menasco produce accurate jigs and fixtures. The latter, as well as tools and gages, are held to unusually close tolerances. Inspection of many parts is made with Jones & Lamson comparators

Engine castings are mounted in jigs or fixtures to speed machining. Holes in plane surfaces on the castings are reamed to close tolerances and fit over dowels in the fixtures, thus locating them for machining operations without the use of tools and gages

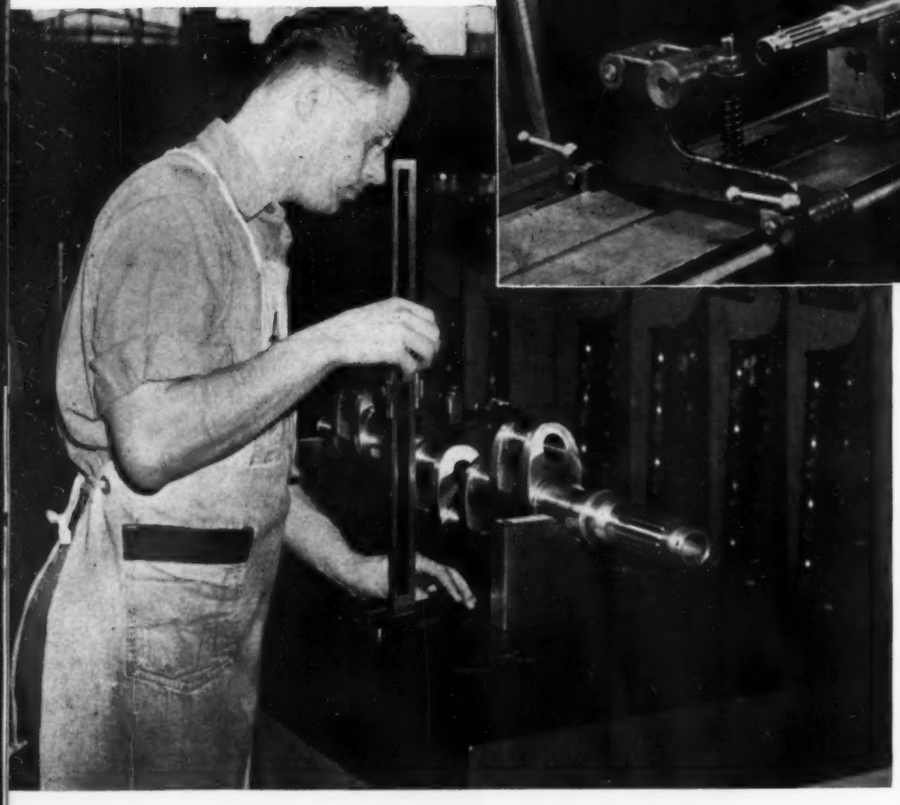
and crankcase-cover holes are drilled. The five main-bearing caps are mounted and the main bearings are bored in a Barnes multi-spindle automatic long-bed boring machine of 20-in. throw. The camshaft bearings are also bored at this time. A special fixture is used to locate the crankcase. Two bearing mount cuts are taken—the first cut to $\frac{1}{8}$ in. of finish size, the second cut to 0.006–0.008 in. of the finished dimension. Later the bearings are line-reamed to a finish of —0 in. +0.001 in. Precision-type main-bearing shells are mounted in the case, while the camshaft is carried on bronze bushings.

Miscellaneous holes for accessories and attachments are drilled in fixtures. The accessory case is an integral part of the rear portion of the crankcase, with a separate cover which also helps to carry the various accessory drive gears mounted in the case on bronze bushings. At this time the accessory mounts are drilled in the rear of the main case, being held to —0 in. +0.001 in. An oil-line hole is also drilled to a depth of 28 in. through four webs of the crankcase. This serves to mount the oil pressure line, which is later rolled into the case.

Cylinder-base holes, hold-down stud holes and tappet-guide holes are bored, and tappet-pad bases



Machined crankshafts are checked for alinement. Minute corrections are made under this hydraulic straightening press



Crankshafts for the Menasco engines receive final inspection on surface plates leveled accurately. Those out-of-line more than 0.001 in. are rejected

are faced in a radial drill. The accessory case flange is then faced on a Giddings & Lewis horizontal mill. The nose is bored and faced for mounting the nose plate which seals the propeller end of the crankshaft, the cylinder base pads are given a finish cut, and, except for minor drilling and tapping operations, the crankcase machine work is completed.

Threads for all main-bearing studs and cylinder hold-down studs are ground on a precision Ex-Cell-O grinder to close limits.

Accessory case boring is done on a multi-head Barnes vertical boring mill. The first operation being to mill both sides, one along the parting line with the crankcase accessory section, and the other in the plane of accessory pad mounts for magnetos, and pumps. The accessory case must carry the starter drive, two magnetos, generator drive, tachometer and oil pumps.

Cylinder-head castings as they come from the foundry are first burred, sand blasted, and painted

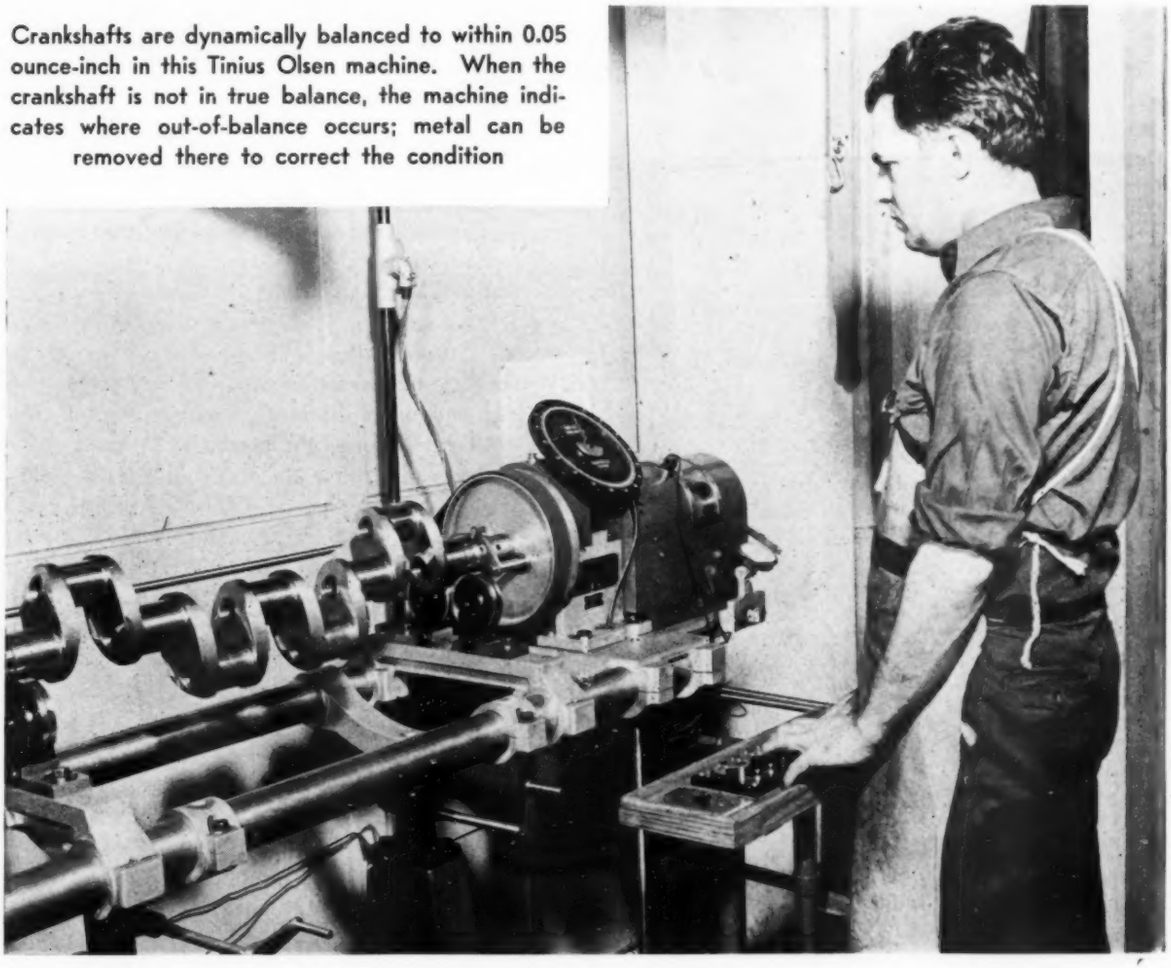
with black heat-resistant paint. The internal cylinder-head dome and cylinder recess are machined in a special precision fixture on a Warner & Swasey turret lathe. Cylinder hold-down stud holes are then drilled and reamed. Valve seats and valve-guide holes are bored in an indexing fixture on a radial drill, as are the spark-plug bushing holes, which are drilled and tapped. Milling machine operations on the head include milling the pads for the inlet and exhaust rocker-box covers, milling the rocker-arm support bosses and the scavenger-line bosses. Push-rod inclosure tube holes are drilled, reamed, and tapped on a radial drill. Valve-guide recesses are counterbored.

For assembly of bronze valve seats and spark-plug bushings, the cylinder heads are preheated to 500 F. in an oven and spark-plug bushings are then screwed and dowelled in place. Valve seats are rolled in against an undercut. Miscellaneous drilling and tapping operations are performed and back spotfacing of valve-spring recesses. The valve recess is carefully blended into the cylinder-head dome on a vertical mill; afterwards, it is hand burred to remove all sharp corners which might tend to induce pre-ignition. Exhaust passages are spotfaced mainly to help streamline them. The cylinder head is then heated again to 500 F. and a steel ring is shrunk in place to serve as a seat for the cylinder gasket. Valve guides are also shrunk into the head at this time.

Other major machining operations are performed on the crankshaft, cylinder barrels, pistons and connecting rods. There are the usual operations, most of them standard, on bushings, washers, and small parts.

Precision equipment of the highest order is maintained for checking all tools, gages and parts where unusually close tolerances are required. A Pratt & Whitney micrometer accurate to 1/10,000 in. and a Jones & Lamson comparator which magnifies 62½ times are part of this equipment. The comparator is especially valuable in checking and controlling stud threads. All drill jigs and special fixtures are manufactured in the Menasco toolroom which is equipped with precision machines for that purpose, including a Pratt & Whitney jig borer accurate to 0.0001 in.

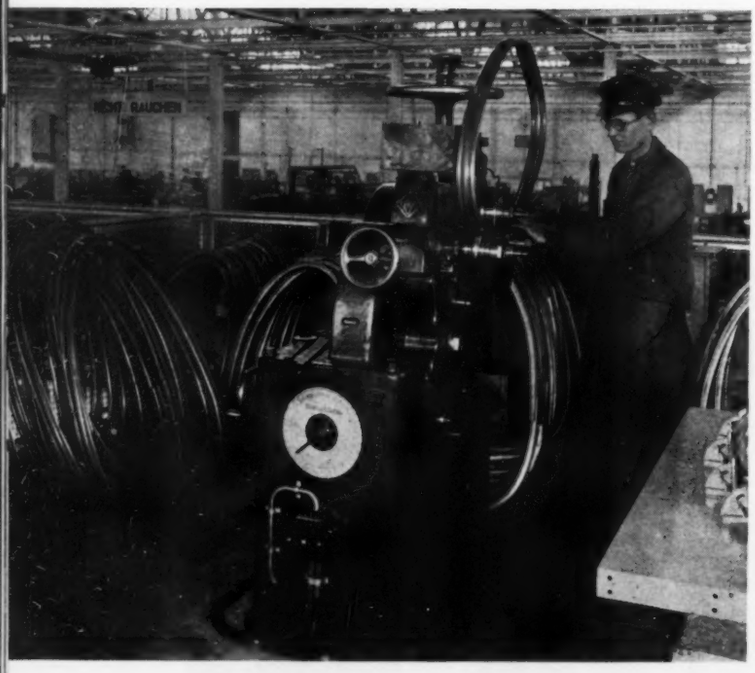
Crankshafts are dynamically balanced to within 0.05 ounce-inch in this Tinius Olsen machine. When the crankshaft is not in true balance, the machine indicates where out-of-balance occurs; metal can be removed there to correct the condition



BEHIND THE LUFTWAFFE

Over one-third of Germany's Henschel Hs-126 observation plane is made of metal stampings

By PAUL H. WILKENSON



Bulkhead rings for the fuselage of German planes are rolled to shape on automatic forming machines. Ring contour is regulated by a cam plate which controls the relative position of the rolls

GERMAN PLANE manufacturing methods are in many respects similar to those in this country. Metal-working equipment and assembly jigs are the essential production elements. Following is a story out of Germany on the Henschel Hs-126, which is the standard single-engine multi-purpose airplane of the Luftwaffe. Powered with an 880-hp. Bavarian Motor Works air-cooled radial engine, it is used extensively for day and night short-range reconnaissance, artillery observation and light bombing. It has a maximum speed of 220 m.p.h., climbs to 20,000 ft. in 12½ min., lands at 59 m.p.h., and has a flight range of 680 miles. It is comparable to the North American 0–47 used in the United States and the Westland Lysander used in Great Britain. During manufacture, it is broken down into 6,000 individual parts, 2,000 of which are sheet-metal stampings.

Henschel Flugzeug-Werke A. G. developed special machines and methods in order that the Hs-126 could be mass-produced without a power assembly line. These special machines have been licensed to manufacturers of machine tools in Germany for supplying other firms in the aircraft industry.

One of the most interesting machines developed by Henschel for aircraft production is a special forming machine. It is used for forming lengths of chan-

Longitudinal stringers for the fuselage and wings are perforated on an automatic drilling machine. A roller feed regulates the spacing of the holes

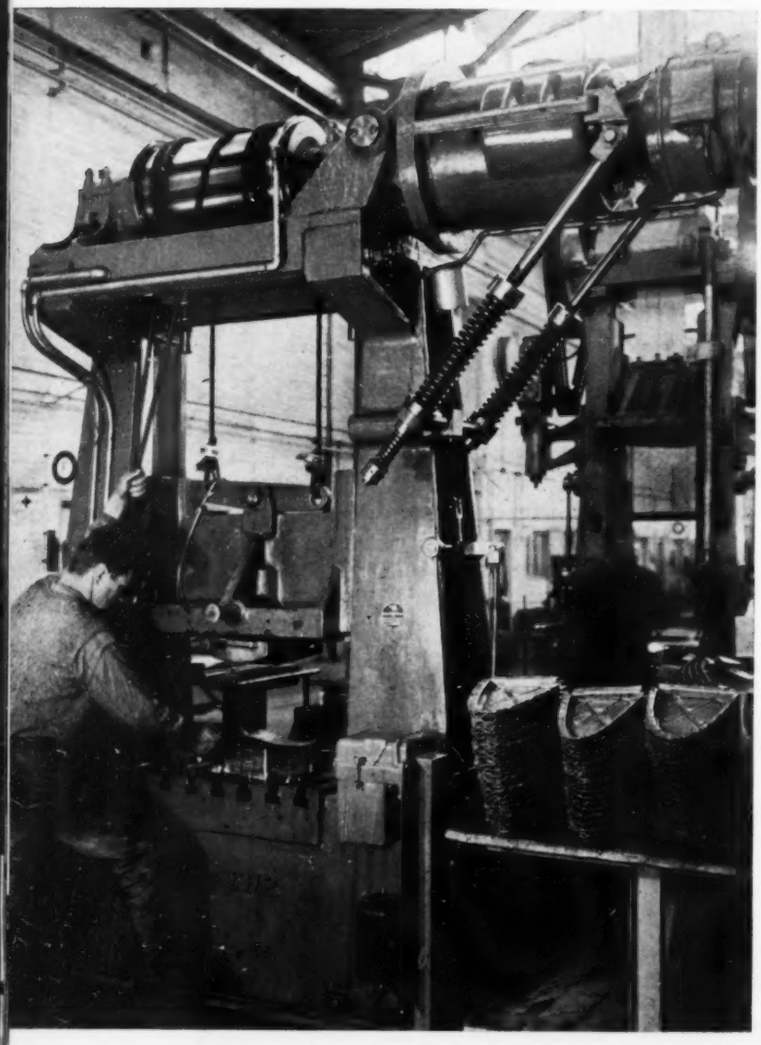
nel-section duralumin into bulkhead rings for the monocoque fuselage. A small sheet-steel cam plate regulates the relative positions of the forming rolls so that the desired contour is produced. All that remains to be done after the ring comes off the machine is to lap the ends in a jig and rivet them together. This machine has an output of 30 rings an hour and requires only a semi-skilled operator.

Another special machine of Henschel design is a high-speed automatic drill on which the longitudinal duralumin stringers used in the fuselage and wings are drilled. The rate of travel of the stringer through the machine is regulated by a roller feed which controls the vertical movement of the drill spindle thereby ensuring correct spacing between the holes. This machine has a capacity of from 9 to 15 ft. of stringer a minute depending upon the thickness of the metal and the frequency of the holes.

Sheet-duralumin parts such as wing fairings, control surfaces and skin covering for the fuselage which require simple curvatures, are drawn to shape on Henschel stretching presses. The forming block is made of wood and the piece of metal to be formed is held in contact with it by means of clamps at each end. The forming block is raised by a hydraulic plunger until the desired curvature is obtained. The piece of metal is then removed from the press, its edges are trimmed to size and it is ready for assembly.

Ribs of sheet-duralumin for the wings are made in three sections to facilitate assembly in the wing

Fairings and other sheet-metal coverings of special contour are drawn to shape on stretching presses. Clamps hold the sheet metal in contact with a wooden form, the latter being raised on a hydraulic plunger



Nose sections of wing ribs are formed under rope-operated drop hammers using metal dies and a rubber platens. Tightening the rope on the motor-operated drum raises the hammer

jigs. A rope-operated drop hammer of Henschel design is used for forming the nose sections. The metal die is secured to the table and the rubber platen is attached to the hammer. An electric motor raises the hamer to its striking position.

The center and rear portions of the wing ribs are pressed out on a Muller (Henschel license)) hydraulic press. This machine is foot operated and fast in action, and is used for a variety of presswork. As in the case of the drop hammer, the die is secured to the table and the rubber platen is attached to the ram.

Approximately 120 dies of various shapes and sizes are used for pressing out parts for the wing ribs, the tail surfaces and the control surfaces of the airplane. Many of the dies used in the drop hammers and the hydraulic presses are made from plaster-cast models which in turn, are obtained from full size mock-ups of parts of the airplane. The frames for the cockpit enclosures and the side frames of the center section of the fuselage are typical examples of parts made in this manner.

The jigs for main assemblies such as the wing panels, tail surfaces and control surfaces are of the vertical type to facilitate assembly and riveting. Many of the jig fittings are standardized so that they can be used again when the jigs are rebuilt for other airplanes.

Several sets of jigs are used for assembling the fuselage which is constructed in three sections. For assembling the front section or engine mount, a welding jig of conventional type is used. All of the parts such as the tubular ring, the four tubular attachment struts and the nine fittings to which the engine is bolted, are made of steel and so can be readily assembled in this manner.

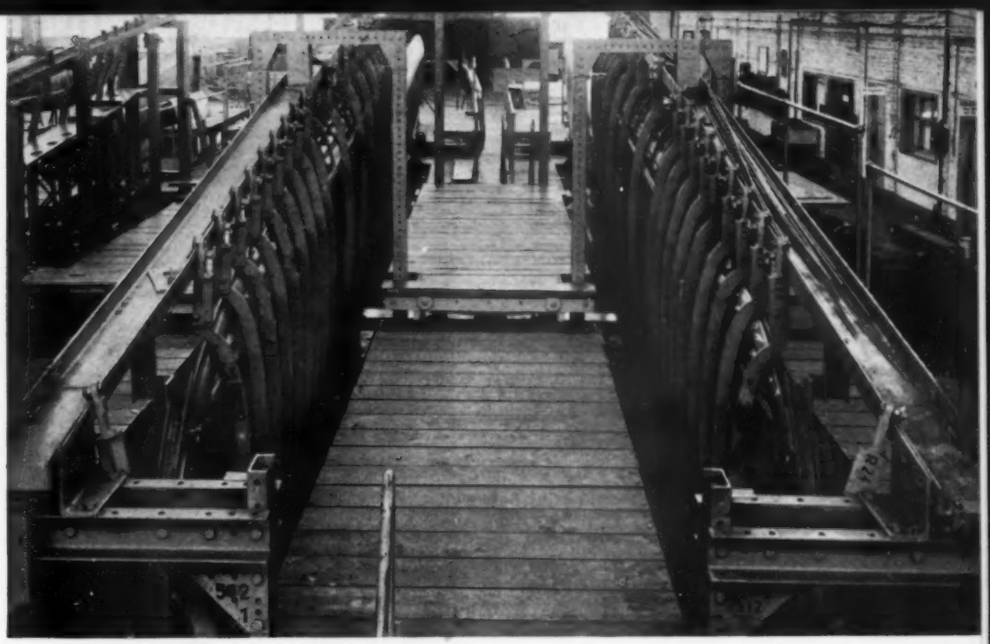
Box-type jigs are used for assembling the center section of the fuselage. These jigs have tubular steel backbones and channel steel cross members. The center section of the fuselage consists of four tubular steel longerons, five built-up bulkheads of duralumin and various castings and fittings. The bulkheads are assembled in large circular jigs of channel steel.

The jigs in which the monocoque or rear section of the fuselage is assembled have contour rings to which the stringers or longitudinal members of the fuselage are clamped. The bulkhead rings are introduced one after another from the front end and are bolted to the stringers. The sheet duralumin skin is then riveted to this framework and the monocoque shell is complete.

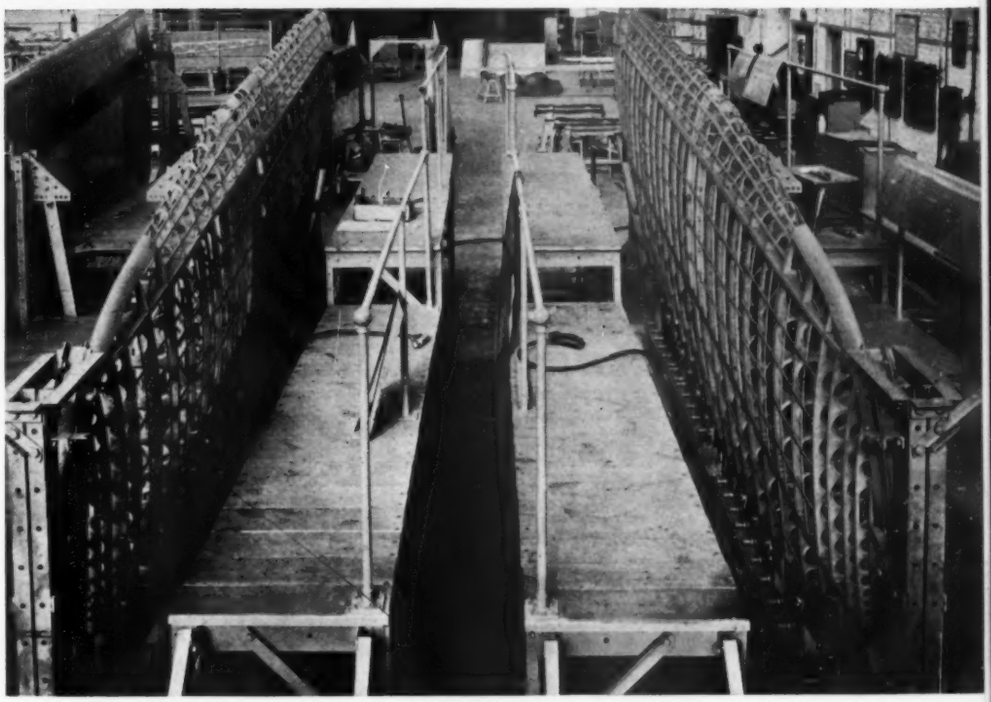
The joining of the center section and the rear section is accomplished in another box jig. The main

Hydraulic presses are used to form many structural members of the Henschel observation plane. The center rib sections are being made on this machine

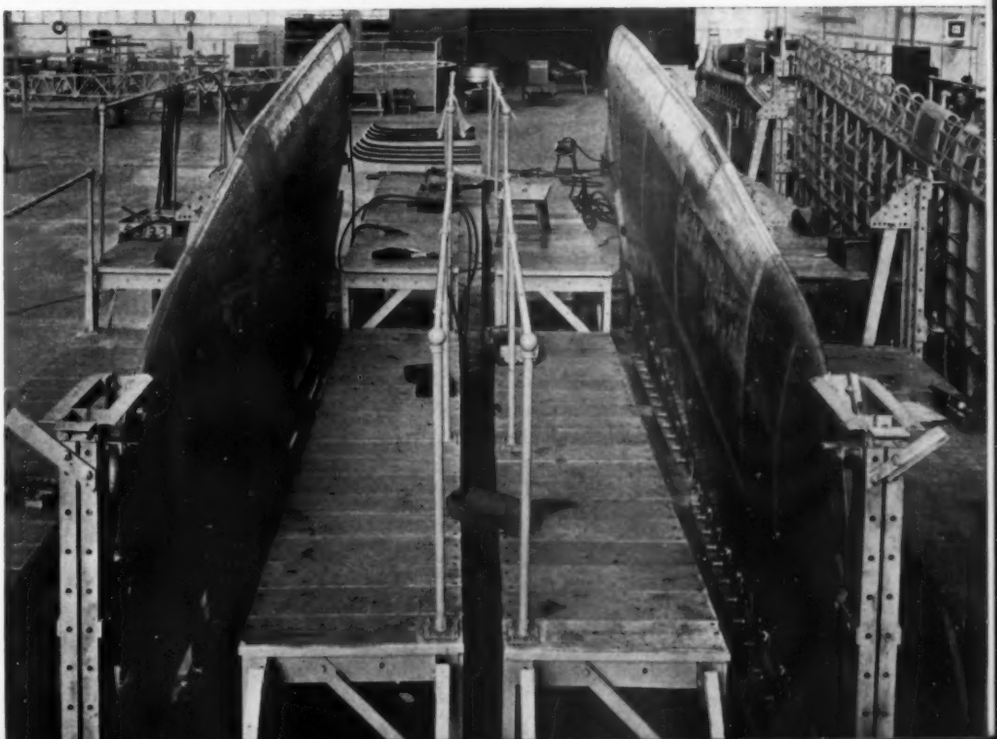
Jigs for assembly of Henschel wings are arranged in pairs for left- and right-hand panels. Three sets of jigs are used to complete each pair of wings; the first set shown here is for assembly of longitudinal beams, compression ribs and wing tips

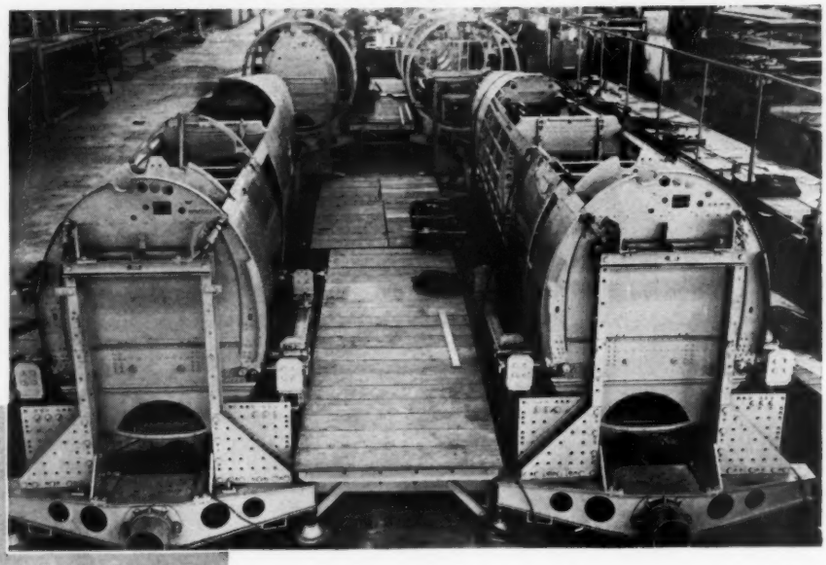


The wing skeletons are converted into wing frames in the second set of jigs. Here the ribs and stringers are riveted in place, and the controls fitted to the panels

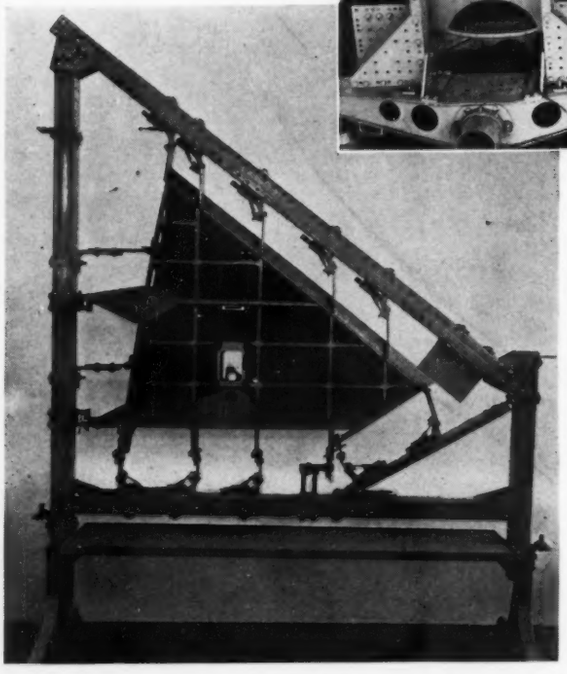


The skin is applied to the wing-panel assemblies in the third pair of jigs. Flush riveting is used on the leading edges and round-head rivets for the surfaces behind the front beams





Box jigs are used for mating the center and rear sections of the fuselage. These jigs have tubular steel backbones and channel-section cross members



Box-type girder jigs are used for assembly of fins and rudders. Quick-release swiveling fittings locate accurately the initial structural members prior to drilling, reaming and riveting other sub-assemblies. The jigs can be knocked down and rebuilt quickly when designs are changed

controls and interior fittings are installed at this time and the side frames are riveted to the fuselage. Then the fuselage is removed from the jig and transferred to the assembly line where the nose section and the engine are added.

The procedure followed for assembling the left- and right-hand wing panels is much the same as that used for the fuselage. In this instance, three progressive sets of jigs are employed so that none of them are occupied too long. The jigs are arranged in pairs, one for the right-hand panel and the other for the left-hand one.

The first pair of jigs is used for assembling the skeletons of the wings. The compression ribs are clamped to jig profile members having the same curvature as the upper surface of the wing. The two wing beams and the wing tips are inserted in the jigs and bolted to the compression ribs. The skeleton wings are then transferred to the second pair of jigs.

After being placed in the second pair of jigs, the skeleton wings are converted into wing frames by adding the remaining ribs and longitudinal stringers. These parts are riveted together, after which the interior fittings and controls are added.

It is not until the wing panels reach the third pair of jigs that the sheet duralumin skin is applied. Flush rivets are used for the surface along the leading edge and round head rivets for the surface behind the front beam.

Jigs of the box-girder type are used for assembling the tail surfaces, the ailerons and the landing flaps. All these jigs are bolted together, have standardized supports and fittings, and are equipped with slotted corner plates to facilitate adjustment and rebuilding. The streamline struts used for supporting the semi-centilever wings on the airplane are also assembled in jigs of this type.

Primarily, the Henschel Hs-126 was designed for mass production and the factory was laid out with this purpose in mind. Flow lines are used wherever possible and sub-assemblies and major assemblies are transported on small motor-driven platform trucks. Everything on the fuselage is assembled prior to the mounting of the wings. Although a power assembly line is not used, the rate of production is high due to the careful coordination of airplane design, special machines and efficient jigs.

Machine Tool Electrical Standards—V

211. Machine compartments for built-in control shall be isolated from coolant and oil reservoirs and shall be located to provide protection from coolant, oil, chips and dirt. Such compartments shall be vented to allow the escape of gases. A machined, metal to metal contact between the cover and the enclosing compartment shall be considered the equivalent of a felt gasket in making the control semi-dust-tight. Compartments for mounting control shall provide ample room between panel and case for electrical clearances and proper maintenance, in accordance with the accompanying table (taken from NEMA Industrial Control Standards 40–59). Such compartments shall have a hinged door with adequate means for fastening when closed.

212. Wherever possible, mechanical adjustments shall not be provided in the same enclosure with electrical equipment.

Mounting

213. Control shall be mounted so as to minimize the possibility of damage from floor trucks or other moving equipment or splashing liquids.

214. Control shall not be mounted in a position that will interfere with machine adjustments or maintenance of hydraulic or mechanical equipment.

Panel Wiring

215. All panel wiring shall be done in a neat and workman-like manner.

216. Control wires on panels shall be of suitable size and shall be supported mechanically where necessary to keep them in place. Wherever possible they shall not be over one layer deep, when run parallel.

217. All terminals for external connections shall be plainly marked to correspond with markings on the wiring diagram.

218. For complex control circuits, it is recommended that all outgoing control wires be wired to a convenient terminal board.

Type of Control

219. Unless the customer specifies otherwise, or the machine requires slower acceleration, across-the-line type starters shall be furnished on alternating current motors. (See NEMA Control Standards 40–59).

Motors—Types and Mountings

300. Motors shall conform to latest standards (whenever they are applicable) of the American Standards Association C50, and the NEMA Motor and Generator Standards 41–64, and American Standards Association Rotation, Connections and Terminal Markings for Electrical Power Apparatus C6.

Type of Motor

301. The type of motor enclosure to be used; whether open, totally enclosed fan cooled, or drip-proof; depends upon the conditions of the individual application and shall be determined by the machine tool builder. If there are unusual conditions in the location where the machine will be installed, customer shall advise the machine tool builder when sending him an inquiry.

Mounting of Motors

302. Motors shall be mounted so far as possible where they are accessible for maintenance and are protected from injury.

Balance

303. Dynamic balance and noise control shall be limited to elimination of machine trouble from these sources.

Starters

304. Unless customer specifies otherwise, or the machine requires slow acceleration, across-the-line type starters shall be furnished on alternating current motors, (see "Control").

Nameplates

305. Whenever the motor nameplate is inaccessible, a plate shall be provided where it can readily be seen, giving horsepower, voltage, amperes, phases, cycles, speed and frame size. Nameplate shall not be removed from motor.

Wiring Standards

400. Current-carrying capacities of conductors as shown in the National Electric Code (1940 Edition) shall not be exceeded.

401. In all wiring, special attention shall be paid to the mechanical execution of the work. Careful and neat running, connecting, and taping of conductors, and attaching fittings, are especially conducive to safety and efficiency.

402. All sharp edges, burrs, rough surfaces, or threads shall be removed from conduit fittings, solid or flexible conduit, or any other part with which the insulation of the wire comes into direct contact.

403. Wiring methods here set forth may be used for voltages not exceeding 600 volts.

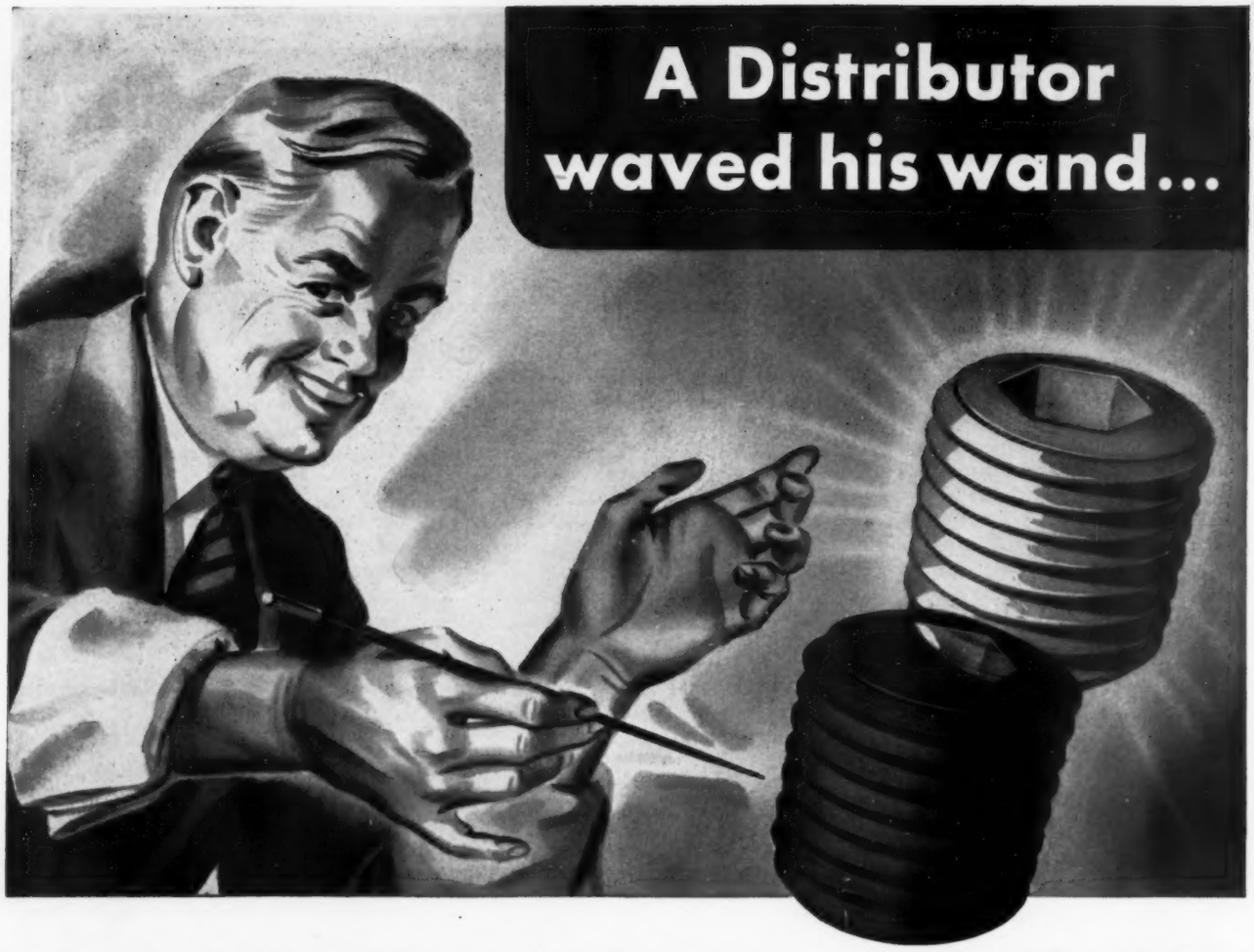
Type of Conductors

404. Power leads, in conduit, shall

CLEARANCES BETWEEN ARC-RUPTURING PARTS AND METAL ENCLOSURE

NOTE—All distances must be measured from the contact tips or arc horns

Horsepower Rating	Distance from Contacts in Direction of Blowout in Inches D.C. and A.C.		Vertical Distance above Contacts without Blowout in Inches				Horizontal Distance from Contacts and Distance below Contacts in Inches D.C. and A.C.	
			D.C.		A.C.			
	300 V.	600 V.	300 V.	600 V.	300 V.	600 V.	300 V.	600 V.
5	1¾	3	4	Barriers	1¾	2	¾	1½
10	2	4	5	Barriers	2	4	¾	1½
50	3	5	6	Barriers	3	5	1	2
100	4	Barriers	Barriers	Barriers	4	Barriers	2	3
Above 100	Barriers	Barriers	Barriers	Barriers	Barriers	Barriers	Barriers	Barriers



..and vital Machine Tools went out on Schedule!

"But I can't use those threaded plugs!" protested the machine tool manufacturer. "They're black—look! *I've* got to have 'em tinned—here, like this one, see? And we can't ship presses with the oil holes open!"

Well, of course there was a resourceful Distributor on the receiving end of this chat and he had a friend who knew about plating. And in a jiffy the plugs were completely treated and the presses were shipped on the dot.

Sure enough—you may never need *plating counsel* from your Distributor. But how fine to remember when you get into *any* jam, that he is just as near as your telephone and ready to pitch in with whatever the help you need most!

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Machine Tool Electrical Standards—VI

be approved 600-volt insulated conductors.

405. Control wires shall be no smaller than No. 14 A.W.G., excepting in multi-conductor cables, in which No. 16 maye be used, excepting also wires used on electronic and precision devices which shall be of practical size.

406. All control wiring shall have 600-volt insulation of approved types, and where subject to oil coolant or any form of moisture or vapor, shall have synthetic (type S.N.) insulation.

407. All wires subject to frequent movement shall be extra-flexible wire.

Control Wiring

408. The designation "control circuits" means the circuits used for the operating control of the machine, as distinguished from the circuits used for power, such as circuits to motors, solenoid brakes, etc.

409. The control circuit shall be taken from a source on the load side of the main disconnect switch, excepting where a separate control circuit disconnect switch is provided in which case it may be taken from the line side.

Identification of Wires

410. Wires shall be identified either by marking with a number to correspond with the diagram, or by the use of colored insulation. Since green usually indicates an equipment grounding conductor and white the grounded neutral conductor of the circuit, these colors shall not be used for any other purposes.

411. When a machine is so constructed that wiring must be disconnected for shipment, terminals and wires shall be marked. Markings shall be in accordance with American Standard, Rotation, Connections and Terminal Markings for Electric Power Apparatus C6.

Reduced-Voltage Control Circuits

412. When alternating current reduced voltage control circuits are required all operating coils shall be 110-volt, except in those cases where the inrush current to the control devices exceeds 15 amp., in which case the coil shall be at line voltage and energized through a relay connected to the regular 110-volt control circuit.

413. Control voltages other than 110 volts may be used where sensitive instruments, electronic tubes or similar devices are used in the circuit. These are, however, special cases. For general purposes, 110 volts appears to be a well established standard.

Conduit and Wire Runways

414. All machine wiring shall be totally enclosed in conduit, electrical metallic tubing, conduit fittings, junction boxes, or sheet metal boxes with the following exceptions:

(a) Flexible connections to moving members.

(b) Compartments and raceways within the framework of the machine, isolated from coolant and oil reservoirs, may be used for housing insulated wires and other electrical equipment.

(c) Wires with synthetic (type S,N.) insulation shall be connected to solenoids operating valves, clutches, and other mechanisms which operate in oil or oil vapor providing the construction and the conductor supporting means are such that there will be a space of at least one inch between such moving parts and the conductor under all conditions of operation, or a barrier is provided between the conductor and the moving part.

415. No flexible conduit shall be installed in, or run through, water or other liquids.

416. Knock-out boxes shall not be used.

417. Openings or raceways in machine framework shall be considered the equivalent of rigid conduit if made smooth and free from sharp edges and if wires are adequately protected from mechanical injury.

418. All conduit shall be securely held in place and supported at each end.

Grounding of Apparatus

Stationary Equipment

500. All control cabinets, motors, metal conduits and control stations and other devices where there is a possibility of contact with current carrying parts shall be grounded. Grounding by attaching the device to the machine tool with bolts or other approved means shall be considered satisfactory.

501. Where the magnetic control panel or where other devices are not mounted on the machine tool they should be grounded by the user.

Moving Machine Parts

502. A machine part that moves on metal guides or supporting ways shall be considered as grounded to the machine but shall not be considered grounded if it may be removed by hand from the machine.

Portable and Pendant Equipment

503. All portable accessories or pendant stations shall be grounded to the machine so as to prevent injury to the operator.

504. The size of the grounding conductor shall be the same as for stationary equipment, as given in the following table:

Capacity of Automatic Overcurrent Protective Device in Circuit Ahead of Equipment Conduit, etc. Not Exceeding (Amperes)	Copper Wire Number	Flexible Conduit or Steel Pipe Nominal Diameter (inches)
15	16	½
30	14	½
60	10	½
100	8	¼

505. The ground wire for the portable or the pendant equipment shall be included as one of the conductors, or may be the steel supporting cable or chain of a multi-conductor cable if such a cable is used. In lieu of this, the equipment may be grounded by means of a flexible or rigid metal conduit, properly secured.

Connections to Accessories

600. Where an auxiliary device must be removed under certain conditions, it may be connected through a plug and receptacle.

601. Plugs and receptacles shall be provided with fitted joints, preferably with gaskets, or with screw-fitted connections. Means shall be provided to effectively seal the receptacle whenever the plug is removed.

Marking of Accessories

602. Each limit switch or other accessory shall be stamped with its number, as shown in the diagram, or its position on the machine shall be shown on a diagram furnished for the express purpose of locating electrical parts.

U. S. Inspectors of Armament Production ★★★

LIMIT RING THREAD GAGES

LIMIT PLUG THREAD GAGES

TAPER PIPE THREAD GAGES

ADJUSTABLE THREAD SNAP GAGES

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Everyone In His Place

THERE IS AN IMPORTANT PLACE for everybody in this war.

For many, that place will be in the active fighting forces. For others, it will be in the country's factories where the munitions with which to carry on the war are made. For still others, it will be in home defense and in providing the essential services without which the nation cannot function in wartime or in peacetime.

On one point all should agree. It will be detrimental to the successful conduct of the war, and will prolong the conflict unnecessarily, if full recognition is not given to the needs of our war factories as well as to the needs of our military services.

In the commendable effort to extend the obligation of military service far beyond the age limits originally set (making all men twenty to forty-four inclusive subject to the draft), care should be exercised to see that war industries are not robbed of men essential to full operations.

Washington is crying loudly, and rightly, for greatly expanded output of war goods and of materials and equipment with which to manufacture them. To take men from any of these important tasks, unless all other sources are exhausted, would be a grave error. It is our sincere hope that every local draft board has a proper appreciation of that fact.

If a person is a skilled operator in an essential war industry, reason dictates that he be kept where he is. Lord Halifax, the British Ambassador, recently pointed out that the war will be won in the workshops. It is America's preponderant industrial production, as well as the skill and bravery of the armed forces of all the Allies, that eventually will bring victory.

Fortunately our Army and Navy officials are on the lookout for draftees with specialized training. They recognize that this is a mechanized war, a war of many skills. All branches of the armed services can use men of technical training. And steps are being taken to see that every man who becomes a part of our military and naval forces is used where he will be of the greatest value.

One other point deserves attention. If the victory program as now contemplated is to succeed, its scope will be so vast and all-inclusive that it will constitute the greatest drain on manpower in the country's history.

Under the circumstances far-sighted employers should prepare now by taking on more older men and by using women wherever possible. Men of middle age and older can contribute generously to the manufacture of essential war goods and can be trained to do new tasks. Women already are being employed satisfactorily in many war factories. They are willing workers, do some jobs even better than men, and will be a bulwark of help to industry when the demand for manpower reaches its peak.

Let's be sure that all our manpower—men and women—is not only mobilized, but used most effectively to win the war in the shortest possible time.

Burnham Finney

GAGING BUSINESS

Machine-tool industry expanding rapidly. Bigger shifts, subcontracting, new plants raise output. English orders diverted. Munitions production mounts. Bomber plan aims at 750 units per month

Wide expansion of the machine-tool industry's capacity to meet the tremendous demands of the Victory program is now under way. The current activity is on top of earlier enlargements which had enabled machine-tool builders to attain operations on a scale ten times normal output. Some 70 to 80 manufatcurers, almost all of whom are engaged in production of so-called critical tools, have been called to Washington since December 8 and asked to step up their capacities sharply. The exact means by which the new capacity is to be acquired has been left to the individual companies to work out. Several means are open—bigger second and third shifts, more subcontracting, new plant additions. A surprising number of companies are choosing to construct new plant facilities, though their factories already are dangerously overexpanded so far as peacetime production is concerned.

Machine Tools—The aim of machine-tool builders is to put to work all the machines in their plants as close to 168 hours a week as possible. Many firms are running three shifts six and even seven days a week, but others are holding to two long shifts because of the shortage of manpower and because they feel that they secure practically as much production on such a schedule as on three shorter shifts. One complaint of machine-tool builders is that a freezing of prices is being imposed upon them, but no price ceiling exists on subcontracting. Several companies are reported to have been threatened with the loss of important subcontractors unless they paid more for the work farmed out. They had no other alternative than to grant the requests, but were barred from putting these extra costs into their machine-tool prices. The ruling whereby machine-tool builders can ask for 30 percent down with war orders, thereby giving much needed cash to meet current obligations, has not yet proved to be so beneficial as planned, for the reason that some government agencies insist upon the down payment being seggregated in a separate fund and frozen until the order is completed. That action obviously defeats the purpose for which the advance payment was intended. The point is that machine-tool builders have had to expand their operations so drastically the last two years that many of them have had embarassingly large proportion of their working capital tied up in materials, work in process, various essential inventories and subcontracting obligations. Payrolls are several times what they were a year or two ago.

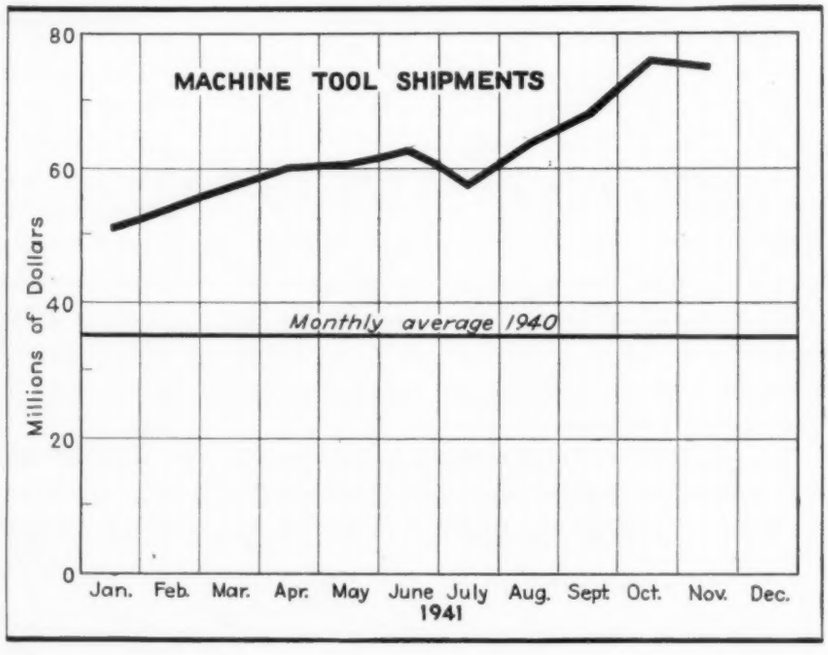
In an effort to get war production rolling as quickly as possible, Washington is holding to its policy of insisting upon all machine tools originally destined for delivery to England being diverted to munitions plants in this country unless such machines are not adaptable to the requirements here. This policy applies to machines for shipment up to March 1 and may be extended beyond that date. Tool orders are being enlarged, particularly in critical tools, to give assurance to companies now operating far beyond their normal scale that they will not run short of business in the near future and that they can produce at full capacity without fear of nearby curtailment of output. Machine-tool builders say that it still takes too long to get a Lease-Lend order placed and that too many machines completed under Lease-Lend arrangements stand on shipping floors for long periods waiting on shipping instructions from Washington. Almost the entire machine-tool industry suspended work on Christmas day, but operated at capacity on New Year's day, not pausing for the usual holiday.

Steel—The war with its need for new bases and new munitions plants, assures capacity production of structural steel for a long time ahead. The most serious problem which now faces the steel industry continues to be the acute shortage of scrap materials.

Munitions—Production rates are mounting rapidly. In many cases new plants which were scheduled to be in operation early next Spring are already turning out essential war goods. December output of TNT was more than double the November volume.

Aircraft—Although an ever increasing proportion of military planes being produced are of the larger type, necessitating more man hours per unit, plane production continues to rise. Output during 1941 was almost triple that in 1940. Personnel employed today totals 425,000, compared with 193,000 a year ago. Good progress is being made in tooling up for the big bomber program, the ultimate objective being the manufacture of 750 units a month. The Army Air Corps have authorized the doubling of Buick's aviation engine production capacity at Melrose Park, Ill. A new and improved Boeing Flying Fotress will be in production soon.

Railroad Equipment—Railroads have agreed to limit the purchase of new rolling stock to certain standard designs to facilitate output. Locomotive and car builders are being assured that they will get a steady flow of materials and will not be handicapped as they were during a considerable part of 1941 by inability to secure light plate steel.



On to a Record — November machine tool shipments of $74,600,000 brought total for the first eleven months to $690,000,000. For the full year, record shipments of $765,000,000 are expected. This is $15,000,000 more than original goal set at year's start

LABOR PLACEMENT UNIFIED IN NATIONAL AGENCY

Jap Threat to Tin Supply Brings Strict OPM Control

WASHINGTON—Next to rubber, tin is the most vital of all strategic materials that would be seriously curtailed or slowed in delivery if the Axis succeeds in occupying Far East source areas or in interrupting passage of our ships on the Pacific.

Planning against this eventuality OPM hurriedly issued order M-43, which forbids fabrication of any imported tin, or disposal of any imported tin except to the Metals Reserve Company. The order permits deliveries of tin on hand in less than 5-ton lots, but such lots will not last long.

Tin Alloy Bearings Necessary

Then will come an order, perhaps before you read this, even more drastic than the control on copper, specifying exactly what you cannot do with tin, what you can do with it, and with how much.

It would be extremely difficult to feed the Army and the Navy from glass food containers instead of tin. Cast iron and other metals can substitute for tin in some machine bearings, but much equipment must have tin alloy bearing metals. Imports of antimony, cadmium, graphite, kyanite (an aluminum silicate used in electric furnaces), mercury, rutile (an iron mineral), vanadium and zircon (a semi-precious stone), were placed under government control.

Imports Under Control

All future contracts for imports of thirteen designated materials, available principally in the Far East, will be handled by the Metals Reserve Company or other governmental agencies, unless otherwise authorized by the OPM. Priorities Director Nelson said that other materials probably soon will be placed under government control.

TEETH PUT IN PRICE LAW

WASHINGTON—A price control bill providing for a single administrator and a modified licensing system has been passed by the Senate subcommittee and was scheduled for Senate action this week. The licensing provisions are invoked as an enforcement measure, but the license to do business could be revoked only by a state or federal court.

Prices of agricultural commodities would be allowed to go higher than parity and there is no top imposed on wages. The latter is said by the bill's sponsors to be unnecessary as ceilings on other things will keep wages in line. When the House passed the law, all teeth had been removed. So far, the Senate has put some bite back into the legislation.

CIO FIGURES WORK LOSSES

WASHINGTON — CIO estimates, from Bureau of Labor Statistics and its own sources, that production losses during the first ten months of 1941 were 2,460,000 man-hours due to strikes; 230,000,000 man-hours due to accidents; 450,000,000 man-hours due to illness; and 1,570,000,000 man-hours due to unemployment. The statement says that unemployment rose 177,000 in October, mostly due to a drop in agricultural employment. Estimated total unemployment during October was 5,063,000.

MANY SUBCONTRACTS MADE

WASHINGTON—The Army Ordnance Department examined 28,781 subcontracts and 4,803 prime contracts from Oct. 26 to Nov. 25, according to a report made recently by Maj. Gen. Charles M. Wesson, Chief of Ordnance. This is a ratio of 6 subcontracts for every prime contract, but in some areas the proportion was much greater—one section ha only 281 prime orders and 4,726 subcontracts, while another had 505 and 7,348.

One prime contractor of anti-aircraft equipment made only 3 of the necessary parts, had subcontractors make the remaining 123. Another company makes some of every part of a gun. It subcontracts with some 15 or 20 firms for additional quantities of the parts, whose manufacture is more time consuming. Still another manufacturer of plastic bayonet scabbards, produces only the plastic component, subcontracts the metal parts.

British-Combine

Sub Nemesis—Depth charges are one of the most effective weapons against submarines. British worker welds shackle ring to head of charge

State units incorporate into USES to speed filling essential jobs; to prepare postwar plan

WASHINGTON—It takes three major elements to make war tackle: materials, manufactories and labor. The materials and the manufacturing facilities have long been under control, but there have been no priorities, no allocations of manpower. The President has just taken a significant step in that direction.

He called upon all governors to turn over their 50 State and Territorial employment services, which now constitute the U. S. Employment Service, for incorporation into "a uniformly and of necessity nationally operated employment service."

Work or Fight Ordered

This democratic government would have to be in a tight squeeze before it would tell a man where he *must* live and what he *must* do. It has already, in effect, told the able bodied men that they must be in a job or a uniform. If the enemy should resist long and hard enough, it might tell the women to get busy.

The new U. S. Employment Service, though it is not yet officially functioning, is already planning collaboration with draft boards. The service and the boards will try to forecast military and industrial need for men, in an effort to prevent as much dislocation as possible.

Will Have Two Functions

The Employment Service will have two big chores to do. The first will be to receive the applications of men with their qualifications for jobs and to place them where they are needed *with the least delay*. Speed is the reason for the consolidation. One authority can work faster than 50. The second job is to plan a post-war cushion for men to light on as they bounce out of war work onto peace times.

Quicker than a trumpet player shifts from A to B-flat is the change from 50 State and Territorial units to one Federal unit. Each state will have a U. S. official. In many, perhaps most cases, he will be the same man who has held the job under the State. U. S. Employment Service has 1,500 full-time local offices, plus 3,000 partime officers.

Raiding Will Be Halted

It is expected the President will issue an executive order, putting all industrial labor hiring under "USES"—as total as total war. The labor market will operate on a regional basis, without regard to State lines; employers

will be relieved, in so far as possible, of competition for skills, and raiding will be stopped. There will be a uniform policy on labor supply.

Short of Skilled Men

Before most Washington insiders knew that such a job was coming up, Arthur J. Altmeyer, chairman of the Social Security Board, picked John Jay Corson to head USES. Corson, a total New Dealer, has been making a good record as administrator in the SSB.

In 1942, war industry will need 3,000,000 additional "persons" and we've got them, but it will go short on plant supervisors and skilled men. This is the forecast of Frank J. McSherry, OPM's chief of defense training. He said 4,500,000 are now working on war contracts, and 9,000,000 will be needed in all by June 1943. He estimates that one man-year of work is necessary to deliver each $2,000 of war contracts.

Must Speed Training

Thus, $50,000,000,000 in funds for war supplies call for 25,000,000 man years. Notice that word "persons." It means women are included—also old men, negroes. McSherry says that training within industry must be steamed up to remedy the shortage of skills and bosses. The only other remedy is to move them out of non-essential industries. McSherry doesn't say so, but this will come about anyway, as a result of materials shortage among the non-essentials. But Mr. McSherry's 50 billion was a mere hypothesis. The real figure is now $74,400,000,000, since the President signed the third supplemental appropriation for 1942.

COPPERWELD HONORS EMPLOYEES

PITTSBURGH—Five employees, including President S. E. Bramer, received twenty-five year service pins from the Copperweld Steel Co. at a testimonial dinner held recently. Others honored were Secretary F. R. S. Kaplan, George F. Bain, Carmen Forgione, M. A. Theim and Michael Shyosky, Sr.

AGENCY AIDS SMALL FIRMS

WASHINGTON — A "small business unit" has been established in the Department of Commerce, of which Jesse Jones is secretary. Its job will be to coordinate during the war the activities of the department which are of use to proprietors of small manufacturing and distributing firms. SBU is headed by William Sheperdson, of New York, former management consultant. Most pressing problem of the small manufacturer has been to get defense contracts or to convert to war production. SBU will try to help.

AIR ASSOCIATES FREED BY ARMY

BENDIX—The plant of Air Associates, Inc., which has been operated by the Army since Oct. 30, was returned to private management last week. Action followed the signing of a contract between the CIO's United Automobile Workers granting employees a modified union shop and general pay increases of ten cents per hour. Frederic G. Coburn, who succeeded F. Leroy Hill as president, told employees that "we've got to pitch in and work together—there must be nothing on our minds except the task ahead."

Complications Forestall Allocations of Materials

WASHINGTON — Allocation of all materials was set months ago by Supplies Priority and Allocations Board as the objective of the priorities system. But the day when every manufacturer can be promised a definite quantity of material on a definite date—instead of a priority rating which may or may not get him the stuff—recedes like a mirage as the weeks pass. The theory is fine and it may be done in industries comprised of only a few units, but the practical difficulties of trying to allocate materials to a great mass of users is almost insuperable.

(Allocation of raw material deliveries by prime producers is another matter entirely, and is already widely practiced in such basic items as tin, pig iron, aluminum.)

Farm Machinery Cut

Latest example of the difficulty is the farm equipment program just announced. It turns out to be just another priority rating. The plan cuts material consumption of the farm machinery industry in 1942 to 83 percent of 1940 volume. The industry, recognized as important to the war effort, is however in a favorable position. It has an A-3 rating on 13 materials. The same rating is available to manufacture replacement parts at 150 percent of the 1940 rate.

Meanwhile, amendment of priorities regulation No. 1—the catch-all order that sets general procedure—makes several important changes.

A provision similar to the "days of grace" clause in the machine tool order protects low-rated orders from being raided by high-rated ones. The new rule says that if manufacturer has completed material to be delivered on a low-rated order or has the material within 15 days of completion, he need not divert the material to a high-rated order coming into the shop. Only exception is orders rated AA.

Another change gives meaningful effect to B priority ratings. Some of these have been issued in the past but there has been no compulsion behind them. Now they have the same force as an A rating.

Wartime Labor Relations Hang on Success of Board

WASHINGTON—The whole future of wartime labor relations now hangs on the success or failure of the War Labor Board which the President, as we go to press, is about to appoint. Success, of course, is a relative term. Unquestionably there will be brief minor strikes—wildcat strikes in unorganized plants, strikes called by local union groups on their own authority. The big question is whether the top union leadership will sincerely try, and will be able, to control their members in accordance with the no-strike agreement reached at the President's Industry-Labor Conference.

The conference resulted in a qualified victory for labor, to the extent at least that the crippling effects of pending anti-strike legislation were avoided and the way left open to further union growth. The overwhelming House vote on the Smith bill did, however, eliminate any big concession to labor in the conference—such as general acceptance of the closed shop.

Industry Would Freeze Issue

The closed shop was the major issue at the conference. Quick agreement was reached on a no-strike clause and establishment of a War Labor Board with power to make binding decisions. But the stumbling block came when industry representatives insisted on freezing the present status of the closed shop. Labor, on the other hand wanted the right to submit closed shop to arbitration like any other issues.

The industry conferees finally yielded, apparently when Senator Thomas, chairman of the Senate Labor Committee and co-moderator of the conference, told them that if they refused to go along witn the conference, the Senate would not approve anti-strike legislation.

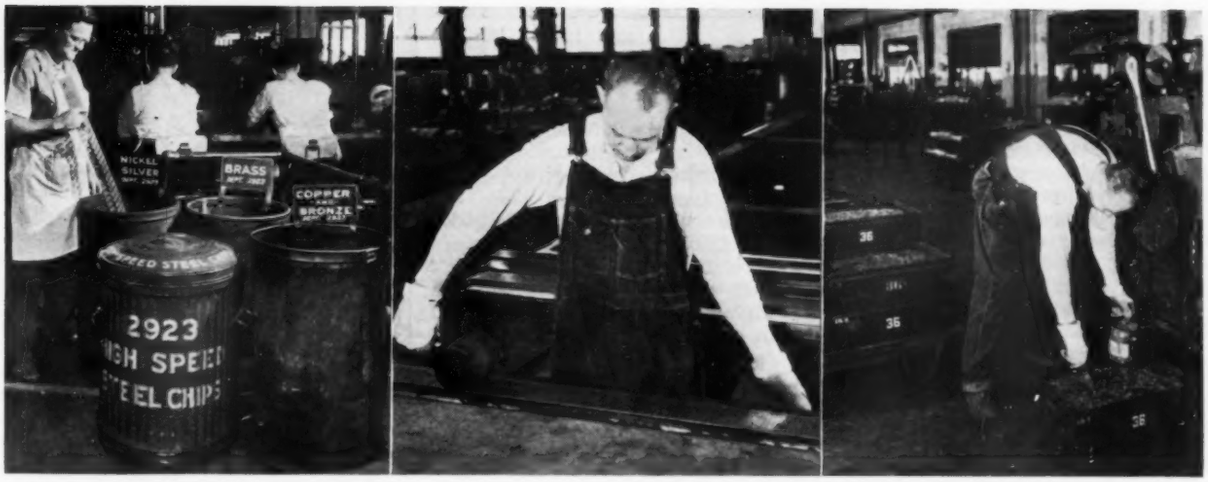
Apparent Mandate

Thus the way is open for further extension of the closed shop. This result will presumably constitute a virtual mandate to the new board to grant the closed shop in cases where any decent showing can be made in its favor.

Until the new set-up has had a fair test, new strike legislation is unlikely, though some congressional die-hards may try to push a bill through. If, however, any major strike breaks out and is not squelched in a matter of hours, Congress may move.

INDUSTRIAL TRUCK ORDERS OFF

CHICAGO—Bookings of electrical industrial trucks fell to $487,879 in November from $1,812,362 in October, according to the report of the Industrial Truck Statistical Association. In all 135 units were ordered.



Fundamental Secret—Identification and segregation of material are the fundamental secret of successful reclamation. Marked receptacles (left) for the collection of scrap are familiar objects in Western Electric shops. Black identifying symbols are printed by a roller on strip permalloy (center). At right, chips from bar milling operation are marked with colored paint. After being classified, scrap goes to centralized reclamation department

WESTERN ELECTRIC RECLAIMS MAXIMUM AMOUNT OF SCRAP

NEW YORK—Declared war has re-emphasized the necessity of full scrap reclamation. Faced with grave shortage of vital raw materials, industry is trying novel methods and adopting methods which in normal days would have been uneconomical.

Several companies, have established reclaiming plants. One of these is the Nassau Smelting and Refining Co., a subsidiary of Western Electric Co., which is charged with the reclamation of non-ferrous metals junked by the Bell System. The fundamental secret of successful reclamation has been found to be identification and segregation of material. Therefore, before the junk reaches the Tottenville, N. Y., plant it is carefully sorted at the manufacturing works.

Works' shops are dotted with marked receptacles for collection of batches of scrap. Other types not suited for collection in ordinary waste cans are marked by color or symbol and moved to the centralized reclamation department for disposal in commercial lots.

Conservation is even extended to slag. In melting nickel-bearing magnetic alloys, some metal is inevitably carried away. Western Electric puts pulverized slag through a magnetic separator which picks up magnetic particles and delivers them into side chutes for reuse. Another saving is made in ickel-plating operations. Short lengths of used anodes are placed in a rubber basket in contact with longer anodes and thus are completely consumed. When rinse water becomes sufficiently concentrated, it is pumped into the plating tank.

Nickel nodules are removed from the contact points of a rotary plating drum for reuse in melting operations

Skeleton Identification—When identification by color or marking code is not feasible, sorting is accomplished by scrutiny of punch press skeleton. This sorting is performed at the baling press (left). Labeled samples of skeletons are posted on bulletin board at workers right. Bales of scrap are lifted pneumatically from the baling press and loaded into skid bins. With a rotating fork truck, bins are dumped into freight cars for shipment

15 Industries Can Produce $4,000,000,000 of Munitions

WASHINGTON—Preliminary conferences are being held by the Office of Production Management with durable goods industries marked for early conversion to war production. The Contract Distribution Division estimates that 15 industry-wide conversions, following the washer and ironer conversion which was very successful, can produce war equipment at the rate of $4,000,000,000 annually.

On the basis of preliminary surveys, CDD estimates that, if production of normal goods were cut an average of 50 percent of 1939 levels, the 15 industries would have a capacity available for war production as follows:

Farm implement, $231,000,000 in tanks; cooking utensils and aluminum ware, $54,000,000 in bomb components, tail fin assemblies, magazine holders, engine cowlings; household appliances, $36,000,000 in bombs, aircraft components; metal furniture, $76,000,000 in fins, rudders, boilers, bombs, ammunition boxes; refrigerator cooling and air conditioning, $481,000 in fuel tanks, engine cowlings, compressors, fuse cylinders, mine sinkers, castings, bomb components, searchlight and motor parts.

Ammunition From Bolt Makers

Bolts, $51,000,000 in caliber .30 and .50 ammunition; sewing machines, $18,000,000 in rifle, pistol parts; railroad and street cars, $101,000,000 in tanks, gun mounts, projectiles; fountain pens and pencils, $15,000,000 in primers, igniters, fuse components; office machinery, $90,000,000 in ammunition, rifle, pistol components; light fixtures, $75,000,000 in cartridge cases, fuse, primer components; stoves, $125,000,000 in wings, rear fuselages, fins, tail planes, rudders for aircraft, radiators, boilers, bombs, ammunition boxes, shell casings, fuse containers, floats, bombs; automobile, $2,500,000,000 in airplane components, gun mounts; wiring devices, $47,000,000 in ammunition; and rubber tires, undetermined in tanks, turret parts, treads.

Walter H. Wheeler, Jr., Deputy CDD Director, who outlined the conversion plan before a House committee, suggested that imposing taxes limiting profits to 1941 levels, would speed the letting of contracts; the government thus would recover any losses in high costs due to hurried negotiation of contracts.

Medium Plant Costs Higher

Wheeler said that cost of war production in moderate-sized plants sometimes runs 30 to 40 percent higher than in large mass production plants, and that initial orders often involve conversion costs equivalent to those of bringing out new models.

Floyd B. Odlum, Director of CDD, says that about $25,000,000,000 worth of durable goods were produced in 1941. By far the bulk of this capacity has not been shifted to war jobs. Much of it cannot be converted for technical reasons; much must not be converted because a certain welfare level of civilian goods must be maintained.

Industry-wide method of conversion is the only way to overtake Hitler's production rate, Odlum maintained. It is the way to make industrial mobilization "selective," just as mobilization of man-power is selective. The government will decide, he says, which industries are best fitted to remain in production of essential civilian goods.

This is how CDD proposes to do the conversion job. The industrial branches of OPM are responsible for dealing with the corresponding industry committees. More industry committees will be set up.

FIND MUNITIONS MAKERS

WASHINGTON—Three classes of manufacturers were established by Floyd Odlum's defense contracting trains that recently completed 40-day junkets covering the U. S. Most important class were the "finds" who can make war goods but didn't know it. Other classes were manufacturers who didn't want to change to war production while their competitors continued in civil work, and companies not equipped to do anything for war. Laws on the books will protect those who feared their competitors.

"Finds" included: shower bath manufacturer who can make cowling for planes; fish-hook maker who can produce springs; toy maker who can fabricate plane fins; piano maker who can turn out Army skis and snow shoes; and a beer-can firm which will manufacture hand grenades.

Army Ordnance Displays Aid Companies Wanting War Work

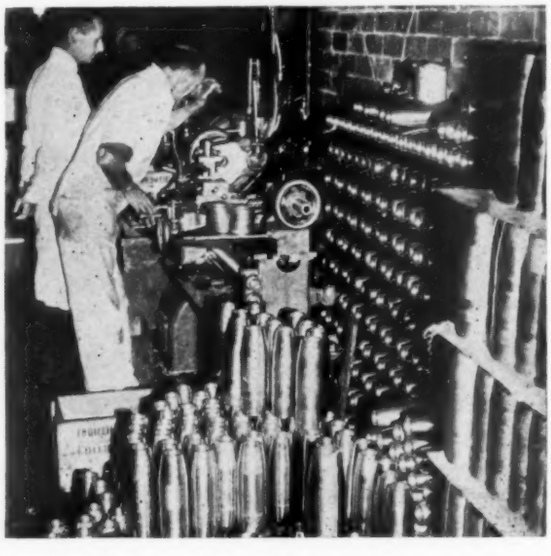
WASHINGTON—Displays of weapons, ammunition, control instruments and many other ordnance items in the 13 district offices of the Army Ordnance Department have been very helpful in pulling manufacturers and subcontractors into the war production program. In addition the offices, which are fully staffed, maintain files of drawings, specifications, and descriptions of manufacturing procedure, the latter based on previous experience.

Potential contractors are able to find out quickly if and how they can be fitted into the Victory program. Items on display in general are confined to those adaptable to commercial manufacture, required in quantity and not manufactured in specially built, single-purpose plants. Included are small arms, cannon, gun mounts, ammunition, mines, bombs and fuses.

Offices are located in Boston, 140 Federal St.; Springfield, Mass., 95 State St.; New York, 80 Broadway; Rochester, Mercantile Building; Philadelphia, Mitten Building; Cincinnati, Enquirer Building; Birmingham, Frank Nelson Building; Detroit, National Bank Building; Chicago, 38 S. Dearborn St.; St. Louis, U. S. Courthouse; San Francisco, Hotel Empire; Pittsburgh, Chamber of Commerce Building; and Cleveland, Terminal Tower.

PATENT OFFICE IN RICHMOND

WASHINGTON—The Patent Office moves to Richmond along with a non-defense hegira from Washington to make room for war business. An effort will be made to keep patent functions in Washington so that lawyers can serve their clients, but there will be a slow down. Examiners will have to depend on couriers speeding the 100 miles between Washington and Richmond with bales of papers.



Speed Shell — War in the Far East has accelerated production of Australia's munitions plants. Eighteen-pounder shell are piled in front of workman who de-burrs firing bands

INSIDE DETROIT

No reversion to "horse and buggy" because of lack of repair parts. Closer check will be made of use to prevent waste. Chevrolet system ties in with auto being repaired. Better contracts expected

BY RUPERT LE GRAND, DETROIT EDITOR

BAN PASSENGER CAR SALES

WASHINGTON — Preparatory to complete halt of production of new passenger cars and light trucks for civilian use, the Office of Production Management placed a ban on all retail sales of automobiles and light and heavy trucks. This order freezes all stocks in dealers' hands until July 15. By that time a rationing system will be established.

DETROIT—Automotive interests discount scare headlines foretelling that the American public must soon go back to the "horse and buggy" era through lack of repair parts. Priorities on repairs may come in time. Perhaps they are inescapable because anti-trust laws enjoin parts manufacturers from adopting a concerted control over parts distribution according to actual need.

A report attributed to the National Automobile Dealers Association states that "thousands of dealers are running short of parts." That is true but has been unnecessarily played up without regard to the over-all picture. Major automobile companies like Chevrolet have been able to build up parts stocks in dealer hands to the largest of record, although service business is keeping pace.

Parts Sales Increase

Wholesale parts sales by Chevrolet are currently from 20 to 60 percent ahead of this time a year ago. The National Automotive Parts Association, comprised of leading independent replacement-parts manufacturers, reports that current business enjoyed by its members is 30 percent ahead of a year ago. Undoubtedly sales would soar higher, if there were unlimited material available and no brakes upon improper distribution.

There has been hoarding of parts by some dealer and service facilities, causing hardships to others. It should be remembered that a large factory-dealer organization is capable of servicing only one-third of the manufacturer's cars on the road. Dealer-service facilities are not geared to handle the entire load because it is industry-wide experience that 50 percent of new-car buyers take service business away from dealers within a year. The percentage rises with age of the vehicle. Thus, factories cannot control hoarding of parts, except insofar as company parts are used by dealers and independent garages.

Expect Car Production Halt

The whole question of replacement-parts production and clean-up of new-car assemblies from parts already produced along with other matters is being threshed out this week at a meeting in Washington. No doubt there will be no further production of cars after Feb. 1, and perhaps Jan. 15, except completion of cars for which parts are already on hand.

In the case of General Motors divisions, it is understood that all parts needed for the original January quota were in the factories by mid-December. A quota for replacement-parts production is likely to be established for the first quarter of 1942, to replace the unofficial working basis for January of 33⅓ percent of the January-March 1941 output.

G.M. Divisions Adopt Plan

Regardless of the quotas finally adopted for replacement parts, the efforts of automobile manufacturers to see that car owners get repair parts according to need will go a long way toward alleviating distress. In the forefront of this program, Chevrolet has been stressing for months an exact inventory control of parts stocks held by dealers. The features of its plan are now being adopted by other GM divisions.

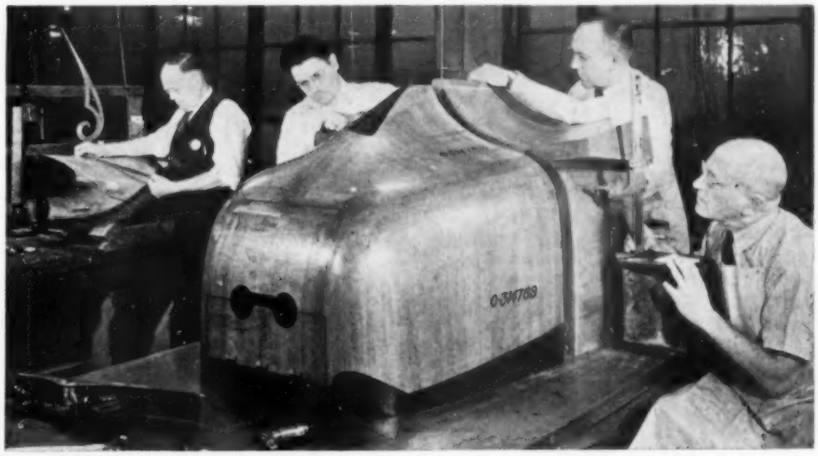
For years Chevrolet has been outstanding in its analysis of the problems which occur in the many phases of its far-flung business. One of its endeavors has been to get dealers to buy repair parts according to the Monthly Inventory Record. Under normal circumstances, dealers were not anxious to spend the time on this procedure, which gives a 30-day check of every item in inventory and reveals sales of each item during the period. But stock replenishment is being exactingly controlled according to repair sales, not anticipated needs.

Excessive Orders Cut Down

The use of this form is checked currently by Chevrolet field men who now devote their entire time to this phase of the business. Excessive parts orders are cut down, according to past records and the Inventory Record. In this way it is hoped to "liquify" dealers parts inventories, assure customers of prompt service, avoid hoarding so that rolling stock can be kept moving, and prevent unnecessary consumption of material.

Private owners and industrial users of Chevrolet cars and trucks will furthermore be assured of prompt repairs through the dealer's use of the car tie up order, a new device developed to speed parts from 52 warehouses scattered over the nation. This order takes precedence over all other business, insures that the dealer gets parts he lacks at the warehouse within 20 min., or that the material will be shipped within a half day after receipt of order.

This order form bears the customer's name, address and the serial number of the vehicle. Any attempt to add ma-



Modeling for War—Craftsmen at the Hudson Motor Car Co., who formerly modeled auto bodies, are now making mahogany models from which dies and fixtures are formed for bomber fuselage sections. Above is the master model for part of the rear fuselage on the Martin B-26 bomber

terial to this order beyond that actually needed for the vehicle in question will be checked at the warehouse, and the Chevrolet field service men will see that the requested material is actually used against a bona fide repair order.

Electrical Equipment Scarce

Behind these systems is the inventory check made daily at Flint. If parts at a warehouse get dangerously low, the items in question are subject to "freeze orders," in which case none can be released to dealers by the 52 warehouses, except by the Car Tie Up Order. These freeze orders have been applied with increasing frequency since last October. Items showing tendency to get scarce are electrical equipment especially, and nuts, bolts, rivets. Altogether some 1,300 fast moving items are subject to the perpetual daily inventory.

No New Contracts

New and more drastic government orders concerning publicity of defense contracts are now being studied by the automobile industry. It is known that the industry ended 1941 with over $4,000,000,000 worth of munitions business on its books. General Motors alone has nearly $2,000,000,000 in defense orders and contracts in the signing stage.

On the whole, however, there has not been a tremendous flow of new war work since the commencement of hostilities. Criticism is still heard of red tape, but on the other hand Detroit expects that Mr. Knudsen will emerge from any OPM shakeup with new authority to place the kind of contract the automobile industry approves—an over-all responsibility contract.

Jones Joins SPAB in Move To Halt Production Delays

WASHINGTON—In a move made to speed up the production of military equipment, President Roosevelt last week appointed Jesse Jones, Secretary of Commerce and Federal Loan Administrator, as a member of the Supply Priorities and Allocations Board. Defense officials for some time have contended that much valuable time has been lost in the building of arms plants, because Mr. Jones was reviewing projects previously passed by SPAB.

As a member of SPAB, Jones will participate in conferences prior to approval of a project. In on the ground floor of planning, Jones will not have to review programs before granting financial approval. Thus, many delays will be eliminated. White House Press Secretary Stephen T. Early said the new position would require "not only his expert advice but his administrative follow through on numerous and difficult financial problems."

DEFENSE ORDERS IN BRIEF

CHROMIUM STEEL—Supplementary Order M-21-d forbids consumption, use, fabrication or delivery of iron or steel containing more than 4 percent chromium, except on ratings of A-10 or higher. All chrome iron and steel on hand must be reported to the Director of Priorities by Jan. 15 on Form PD-221.

SMELTERS, REFINERS—Preference Rating Order P-73 grants to accredited smelters and refiners of copper, lead, zinc, antimony, mercury and cobalt these preference ratings: A-3 for essential repair, maintenance and operating supplies; A-1-a for actual breakdown and suspension of manufacture; and A-1-c for advance provisions to avert breakdowns.

REPAIRS, MAINTENANCE—Preference Rating Order P-100 replaces the old repair and maintenance Order P-22. It differs only in technical details.

DIESEL ENGINES—Informal arrangements whereby diesel engine prices will not be increased above levels of Oct. 1 are continued.

FARM EQUIPMENT—Limitation Order L-26 restricts use of materials for farm machinery to 83 percent of amount used in 1940 and permits use of materials for repair parts at a rate of 150 percent of the 1940 level. Preference Rating Order P-95 grants an A-3 preference rating for procurement of materials needed to fulfill production requirements.

FERROCHROMIUM—To conserve higher grade ores, all manufacturers have agreed to change ferrochromium specifications from 68 to 69 percent chromium, 4 to 6 percent carbon and 1 to 2 percent silicon to 60 to 63 percent chromium, 6 to 8 percent carbon and 4 to 6 percent silicon.

FOIL—Limitation Order L-25 curtailing lead and tin foil use is held in abeyance, pending completion of the tin limitation ruling (see p.34c).

SMALL ORDERS—Extension of preference ratings on orders involving less than $500 worth of material has been simplified. Manufacturer may now attend to the extension without having a contracting officer go through previous routine. Procedure for orders over $500 is not changed.

VANADIUM—General Preference Order M-23a, replacing M-23, places vanadium under complete allocation by the Director of Priorities. Allocations will be made monthly without regard to previous preference ratings.

ALLOY IRON—Alloy iron and steel can not be melted or delivered after Jan. 1 except in accordance with a priority rating if it contains any of these elements in the specified or greater percentage: Manganese, 1.65; copper, 0.60; chromium, 0.60; molybdenum, 0.60; nickel, 0.60; cobalt, tungsten or vanadium in any intentional amount.

PETROLEUM EQUIPMENT—Under Priority Order M-68, use of material and equipment for oil production requires specific permission of the Priorities Division except for maintenance, repair and operating supplies; drilling new wells; exploration; pumping and lifting.

ELEVATORS, ESCALATORS—Preference rating Order P-91 grants an A-2 preference rating to expedite manufacture of elevators, escalators and dumbwaiters for defense use.

AIRCRAFT—Preference rating orders giving priority assistance for aircraft production are extended until Jan. 31.

SEIZE SCARCE MATERIAL

WASHINGTON—Large quantities of scarce critical materials, being held in warehouses and railroad terminals for shipment to foreign countries, have been requisitioned by the Priorities Division, Office of Production Management. The seizures were the first move made under the requisitioning authority extended to OPM in an executive order signed by President Roosevelt.

More than 13 million pounds of steel in bars, plates and shapes, 3½ million pounds of electrolytic copper and 34,000 lb. of tin, on order for shipment to European countries, have been taken over by the Navy Department, with the approval of the Priorities Director. All of the stocks of steel seized had been located by the Bureau of Research and Statistics of the OPM, as a result of its survey of immobilized inventories. The copper and tin supplies had been reported directly to the Navy Department at Washington.

WARTIME WASHINGTON

Consolidation of war production sought. Nelson-Henderson group, many Congressmen advocate civilian agency. Army and Navy opposed, want control in their hands. Knudsen now satisfied

BY BLAINE STUBBLEFIELD

WASHINGTON — On the production side of the war effort, the hottest problem now facing Washington is that of consolidating the two great groups dealing with munitions output. On the one hand are the emergency "defense" agencies—SPAB, OPM, OPA, etc. They have what started as an advisory planning function but has now become a job of regulating the economy of the country, getting it into shape to do the war job. On the other hand are the armed forces, placing most of the actual contracts—more or less in accordance with the programs developed by Supply Priorities and Allocations Board and Office of Production Management.

Complicating the picture are other agencies: the Maritime Commission buying ships, the Reconstruction Finance Corporation financing plants and the like, all pursuing their own lines which invariably do not fit into an overall program. This division of authority, under the stress of war, has now become intolerable to nearly all concerned. But there is no agreement on the next step.

Civilian Agency Proposed

Most influential in the administration, probably, are those who would resolve the conflict by absorbing into the civilian agencies the entire job of war production. They would give to a civilian agency—presumably some modification of OPM—the power to award contracts, and leave to the soldiers and sailors the job of fighting. At present neither OPM nor SPAB can award a single contract, although they have limited veto powers over Army and Navy contracts.

This appears to be the view of Nelson, Henderson, and the group around them—men who for the past year have been consistently pushing for a bolder, more imaginative production policy. In Congress, the same scheme has been brought forward by the House committee on interstate migration. This committee started out to look into the "Grapes of Wrath" situation, has evolved into an investigation of the defense program — concerning itself with social effects where a group such as the Truman committee deals mainly with financial matters. The committee came out last month with a report urging that procurement be centralized under a "civilian ministry of supply."

War Work Distribution Is Aim

The committee is aiming primarily at a more equitable distribution of war business to reduce the dislocations of peacetime life. Henderson and Nelson are thinking more in terms of increased production. But common to both is the view that when half to two thirds of the economy is devoted to war, as will be the case in a year or so, arms buying ceases to be merely procurement, becomes a matter of running the country which is not a matter for soldiers.

Patterson Opposes Scheme

The services aren't taking this lying down. Undersecretary of War Patterson told the House committee he is unalterably opposed to any such scheme. "The placing of orders or subcontracts by civilian authority," he said, "would not only disrupt the system of procurement now in effect . . . but might lead to the production of articles which might have to be rejected."

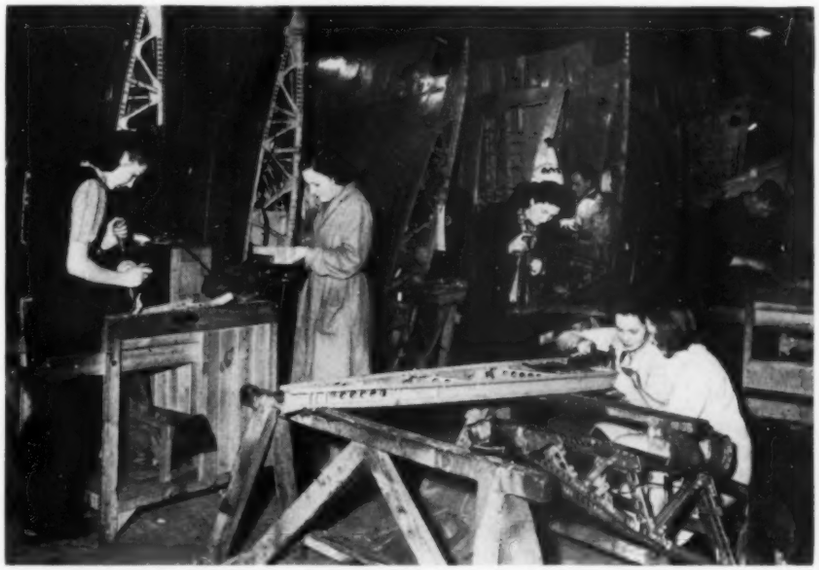
But the present divided authority isn't satisfactory to the Army and Navy either, and they are conducting quiet campaigns to take over the whole job themselves. This was foreshadowed months ago when Army's Ordnance Bureau absorbed OPM's tank unit. And right now the War and Navy departments are initiating moves to take over certain items on which they aren't satisfied with OPM's performance.

Present Set-up Satisfactory

The ministry of supply idea is also opposed by OPM Director Knudsen, who feels reasonably well satisfied with the present set-up. These cross-

SIMPLIFY ARMY CONTRACTING

WASHINGTON — Procedure in awarding Army contracts by competitive bidding is considerably simplified by a new ruling of the Under-Secretary of War. Where previously all contracts for more than $50,000 had to clear through Washington, regional procurement officers are now authorized to award contracts to low bidders up to $5,000,000. Negotiated contracts, as hitherto, must be cleared with headquarters.



Plane Hospital—The British Royal Air Force established plane hospitals where damaged aircraft are reconditioned for further service, or dismantled and parts used for replacements in other machines. Girl workers, above, are repairing damaged "Spitfire" wings. This fighter along with "Hurricanes" is readily treated in "hospitals"

currents within the civilian agencies themselves are what's behind last month's puzzling transfer of responsibility for the OPM commodity branches dealing with civil industry from Henderson to Knudsen. The shift was puzzling because it seemed to strengthen Knudsen, whose influence in Washington lately has been diminishing.

Actually the shift was initiated by Henderson and Nelson, was to have been coupled with appointment of a deputy OPM director of their choosing. Knudsen who still controls internal structure of OPM stymied the scheme in mid-passage by eliminating the second part. The original idea was intended to tighten up the loose organization of OPM to get it in shape to take on the procurement job.

U.S.-Canada Cooperation Expedited; Act on Tariffs

WASHINGTON — Long pending schemes for closer integration of Canadian and U. S. production are gradually coming to a head, and a good many manufacturers are going to find their dealings with the Canadians increasing over the coming months. Of greatest immediate effect is the new Lend-Lease arrangement with Canada.

This new arrangement is going to remove a good many of the limitations on available dollar exchange. It largely supersedes a scheme worked out early this year by which we agreed to support Canadian exchange by buying up at least $300,000,000 a year of Canadian goods. Moreover, we agreed to furnish Canada, under Lend-Lease, with parts and materials for war goods being built in Canada for shipment to Britain.

Red Tape Troublesome

The first part of that scheme has worked pretty well, but the latter arrangement became so enmeshed in red tape that it was practically abandoned.

The new plan sets up Canada as one of the countries entitled to Lend-Lease aid on its own certification—thus eliminating the bothersome business of establishing the British destination of Lend-Lease shipments. In effect, aid to Britain is pooled on a continent-wide basis.

More significant in its long-run implications was the broad general agreement announced by the White House last month. But a lot of bugs need to be ironed out before it will mean much in practice. In essence the President directed that broad studies be made of the possibilities of coordinating U. S. and Canadian war production and that the possibility be explored of eliminating import duties on war goods crossing the border.

The later point is crucial. There are obvious difficulties in asking a U. S. manufacturer, say, to develop parts or material suppliers in Canada—or vice versa—if a duty is going to be imposed midway in the assembly process. Again, one of the production possibilities being studied is that Canada abandon its plans for steel expansion—for which it has only rather low-grade ores available—and instead go in for greatly expanded brass output. Here again duties, now or after the war, impose an obstacle. It's an obstacle that, in part, arises from "Business As Usual" thinking, but that's a kind of thinking that will be with us for a long time.

Congress May Balk

Trouble is that in this country there is no wartime power to waive tariffs. Legislation is needed. And if there's one subject that makes a Congressman queasy it's tariffs. If it's to do any good, legislation would have to define war goods so broadly that a free-trade minded administration such as this one could make it cover almost anything. Congress may balk.

Canada Looks to Washington for Joint War Plan; Civil Production Curtailed or Ended

OTTAWA—Difficulties in the way of implementing the recommendation of the joint United States-Canada war production committee for the pooling of industrial war effort are seen here as centering in Washington. Chief reasons are that Canada is well ahead of the U. S. in curtailment of consumer goods requiring scarce materials (especially metals) and that Ottawa has a much clearer pattern than Washington of the needs of war and other essential industries and border-line industries.

One Ottawa proposal for operating the production pool calls for: (1) mutual acceptance of the principle that the raw material supplies of both countries shall be regarded as joint stocks for use on equal terms; (2) agreement that war requirements shall be met in full to the extent that available materials permit; (3) agreement as to the proportion of the scarce material requirements of essential civilian industry that shall be filled; (4) agreement of the proportion of the needs of border-line industry that will be granted; and (5) proportions must be the same for both countries.

Placed Drastic Curbs

The proposal is not being pressed because Ottawa officials recognize that while the needs of the various classes of Canadian industry are fairly definitely charted Washington would almost certainly object that it isn't possible to assess the absolute needs of corresponding industries in the U. S. Although Canada acted independently in putting drastic curbs on production of consumer goods involving scarce materials, Canadian authorities accept the view that in the end considerations of major concern to the United States must determine the final pattern of coordination.

Canada's first concern is this country's requirements of U. S. steel, placed now at around 2,000,000 tons—up from 1,800,000 tons since the war extended into the Pacific. Canadian authorities feel that the establishment of the principle of a common war effort should call a halt to Washington's haggling over the allocation or priority terms on which the vital steel needs of essential industry in this country are to be supplied.

Supply Materials Without Conditions

Negotiations have been under way for three months without producing a mutually acceptable formula. The view here is that, with Canadian non-war consumption of steel reduced very close to essentials and with this country supplying aluminum, zinc, nickel and other materials to the U. S. practically without conditions, Washington should be prepared to trust Canada to see that the demands of this country for U. S. steel are confined to vital needs without insisting on allocation or priority ratings for every order of steel from this side of the border.

Canadian industry—especially metal working divisions—entered the new year reconciled to the prospect that what remains of non-essential production of civilian goods will be virtually eliminated during the next few months. Additions are being made to the long list of metal products—extending from bicycles through scores of household appliances to furniture—on which production was discontinued entirely Dec. 31. The remaining stocks of these goods must be out of the manufacturers' hands by April 30.

Radios Cut Further

Other commodities on which production was curtailed in October have been subjected to further curbs. Radios are cut to 50 percent of 1940 production, electric washers and refrigerators to 60 percent. Makers employ their advertising space in newspapers and magazines to urge consumers to avoid new purchases where old appliances are still serviceable. (Canadian industry broke all records in advertising outlay in 1941 but agencies expect production curbs will result in a drop of 10 to 15 percent this year.)

Supplementing direct production curbs, Wartime Prices and Trade Board, the price-ceiling administration, imposed additional restrictions on instalment buying in the last week of the year. Used refrigerators, washing machines and other appliances sold on instalment terms are not permitted to be turned in as first payment (fixed

at one-third of the selling price) on new articles. Initial payment must be in cash. Automobiles are exempt from the restriction but are expected to be under more severe direct production cuts soon. Production of private passenger cars in 1941 was about 40 percent of 1940.

Subcontracting Successful

Most Canadian plants forced out of civilian production already are working on war orders and their remaining capacity is being absorbed under the rapidly expanding sub-contracting system. Since Japan entered the war Munitions Minister Howe's department has been mapping enlargement of the war production program through utilization of existing plant. New plants will be built only if present facilities are wholly inadequate.

By the end of the year keels had been laid for 32 ships in the cargo vessel program of government-owned Wartime Merchant Shipping Limited. Five of the ships have been launched. The company is now starting work on small cargo boats of 4,700 tons.

A contract for 1 million armor-piercing shot at the rate of 100,000 a month placed by Howe's department last May with W. H. Banfield and Sons, Toronto, has been withdrawn from that company and given to St. Catharines Steel Products Limited because the former company was behind the production schedule.

Full Tax Expected on Profits

Although Canadian war taxation policy for 1942 will not be finally determined until Finance Minister Ilsley drafts his budget—probably in March—Canadian business faces the possibility of a 100% excess profits tax. The present high is 85%. Political reasons are behind a proposal to go all-out on war profits. A man-power draft is impending and administration advisers figure it will provoke demands for further confiscation of profits. Income tax rates are practically certain to be upped. The price ceiling precludes increases in excise or sales taxes except on luxury goods.

CINCINNATI BICKFORD BUILDS

CINCINNATI—To help meet the Office of Production Management's request for more and more machine tools this year, The Cincinnati Bickford Tool Co. is building an additional 75,000 square feet of manufacturing space. The plant had already expanded greatly. Previous additions in early 1941, enabled the company to produce 75 percent more machine tools last year than in 1940. And, 1940 shipments were twice as large as any previous year, according to August H. Teuchter, president.

Power Shortage in 1942-43 Looms; Turbine Delivery Lag

WASHINGTON—Office of Emergency Management says there will be a serious power shortage in 1942-43 in strategic defense areas. One reason is that it takes two years to build steam or water power plants. The other is that it takes nearly as long to build steam turbines, and deliveries are far behind the need of electric power plants, the Maritime Commission, and the Navy, big three users of turbines.

Total steam turbine capacity ordered in 1940 was 3,000,000 kw. and in 1941 it is 4,500,000. Probably not more than 2,000,000 kw. of this amount has been completed, leaving 5,000,000 kw., which will be delivered during the coming two years.

Schedule Worked Out

Somewhere in Washington, where no press writer can see it, is a steam turbine delivery schedule, worked out jointly by the Navy, Maritime Commission and Federal Power Commission, covering the next three years, and somehow equalizing these three urgent needs.

It takes about 12 kw.-hr. to produce a pound of magnesium by electrolysis, or 10 kw.-hr. by means of the electric furnace. It takes 100 kw-hr. to take ten pounds of aluminum from alumina.

A battleship's turbines develop 150,000 kw. The turbines being built for the two-ocean navy and the Merchant Marine total about half the installed power plant capacity of the country.

Many general licenses under which shipments of strategic and critical commodities are now made will be eliminated. The filing of individual applications for licenses will give the board an opportunity to examine each proposed shipment in the light of wartime requirements.

LICENSES REQUIRED ON EXPORTS

WASHINGTON—Exporters will have to have individual licenses for the exportation of a long list of manufactured items and materials now being shipped out under general license, according to an announcement by the Board of Economic Warfare. The order does not necessarily mean that exportation will be prohibited, but it indicates that articles and materials of which there is a shortage will be withheld from shipment. Detailed information will be made in Comprehensive Export Control Schedule No. 5, which is not available at this writing.

OPEN THREE PRIORITY OFFICES

WASHINGTON—The Priorities Division, Office of Production Management, opened district offices recently in: El Paso, Tex., under R. C. Stryker, manager; Tampa, Fla., under T. L. Hausman, manager; and Phoenix, Ariz., under C. S. Jamison, manager.

Victory Stake—In the Army Ordnance Department's arsenal in Elwood, Ill., many women are performing the tedious and exacting operations in the manufacture of fuses. Worker operates a staking machine on fuse cases. Each case must be tooled with identical care

OCD Issues Instructions For Workers in Air Raids

WASHINGTON — Instructions for workers in industrial plants in the event of air raids are issued by the Office of Civilian Defense:

1. Keep working until air raid alarm is sounded.
2. Take cover.
3. Keep cool.
4. Do not telephone or shout—listen to your air raid warden.
5. If you have a plant defense post, take that position at the sound of the alarm.
6. Take necessary safety measures for your machine and tools.
7. Do not show lights.
8. Fight incendiary bombs. Conflagrations are avoided by controlling such bombs at once.
9. Remain at alert in the prescribed safe place until the "all clear" signal is given and then return to work.
10. Remember that this is a war of production and that production must continue. Your plant is taking every precaution for your safety.
11. Keep cool and help others to keep cool.

NAMES in the NEWS

K. R. Beardsley has been named sales manager, Carboloy Co. Inc., in a move to centralize the sales engineering department of the company. At the same time two new posts as assistant sales

New Products Head

George H. Woodard was recently appointed manager, new products division, Westinghouse Electric and Mfg. Co. He joined the company when the new products division was created in 1936

manager have been created, and are being filled by Martin Muhling, former special engineering executive, and Earl Glen, former Pittsburgh representative.

John H. Davey of the Chicago Office, Brown & Sharpe Company, has retired after 46 years' service with the Brown & Sharpe Mfg. Co., and its subsidiary.

O. V. Greene, assistant metallurgist, Carpenter Steel Co., was promoted to manager of tool steel sales. Prior to joining the company in 1928, he served as metallurgist with the Reading Railroad Company.

Edward P. Hamilton was elected president, Hamilton Mfg. Co. Also elected to offices in the firm were Harold G. Evans, vice-president in charge of sales, and Wilburg G. Dickson, secretary and treasurer.

Elliott Harrington, sales manager, General Electric's Air Conditioning and Commercial Refrigeration Department, Bloomfield, N. J., has become manager of sales, Induction Motor Section, General Electric Motor Division, Schenectady, N. Y. He has been connected with the G.E. air conditioning and automatic heating activities for about ten years.

James B. Hayden was elected recently vice-president in charge of sales, Industrial Brown Hoist Corporation.

Paul R. Hasson, former chairman of the board, John Fowler & Co., English agricultural implement manufacturers, has been appointed to the farm equipment and tractors unit, Office of Price Administration. A native Californian, he had been connected with John Fowler & Co. from 1912 until 1940. He resigned and returned to America to serve the U. S. Government.

Carter C. Higgins has been made assistant general sales manager, Worcester Pressed Steel Co. For the past two years he acted in the capacity of export manager and was in charge of government contract negotiations.

Raymond W. Keller resigned as assistant to works manager, East Springfield plant, Westinghouse Electric & Mfg. Co. He will become vice-president and assistant general manager, Milton Bradley Co.

John G. Kura has been appointed to the technical staff, Battelle Memorial Institute. He had been associated with the Carnegie Illinois Steel Corp.

Paul W. Rhame, works manager, and Charles W. Crick, assistant to the general manager, have become executive assistants to the general manager, AC

PAUL W. RHAME

Spark Plug Div., General Motors Corp. Mr. Rhame will continue to head the present machine gun production activity as well as production on new defense items. Mr. Crick will be executive assistant on automotive and regular products. Joseph Anderson, assistant works manager, will be works manager in charge of defense and automotive products. Miles Hanson, superintendent, has become assistant works manager in the machine gun department, while Lee Sherrod, superintendent, will be assistant works manager on automotive and regular products. Mr. Rhame will be assisted by Morris Allen and Meredith Spear.

BUSINESS ITEMS

Carnegie-Illinois Steel Corp. appointed T. Lane Watson, manager of sales, Cincinnati District, to succeed William P. Andrews. He had been assistant manager of sales, Chicago District, and since 1910 has served continuously with United States Steel Corp. subsidiaries.

Dresser Mfg. Co., and Bovaird & Seyfang Co., both of Bradford, Pa., have been merged.

Fafnir Bearings Co., New Britain, Conn., has purchased the former knife factory buildings from Landers, Frary and Clark.

The International Nickel Co., Inc., has named W. J. Calnan, H. D. Tietz, and E. A. Turner assitsant to the Monel sales manager, J. F. McNamara. H. E. Searle, former assistant to Mr. McNamara, has been transferred to the Nickel Sales Department. C. J. Bianowicz replaces Mr. Turner as head of the chemical section, Monel sales.

Sparks Machine Tool Co. has moved into new offices at 32-34 Main St., Norwalk, Conn.

OBITUARIES

Thomas Littleton Gibson, 56, designer for the Bickford Machine Tool Co., died recently in Cincinnati. He had been employed by the company for 25 years.

W. J. Radcliffe, president of the E. A. Kinsey Co., and member of the Board of Directors, Giddings & Lewis Machine Tool Co., died December 2 in Cincinnati.

Elwood E. Seacrist, 71, foundry superintendent, W. A. Hardy & Sons Co., died Dec. 19 in Fitchburg, Mass.

H. Howland-Shearman, 75, inventor who developed a method of causing cold flow of metals through the application of pressure, died recently in New Haven, Conn. He was a member of the Royal Institute of Great Britain.

MEETINGS

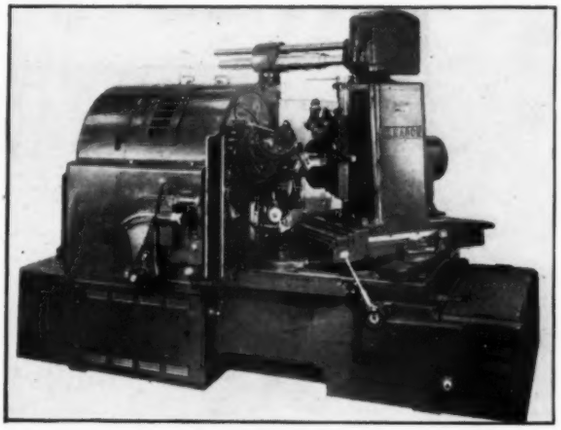
American Management Association, Annual Personnel Conference. Stevens Hotel, Chicago, Ill., February 4-6.

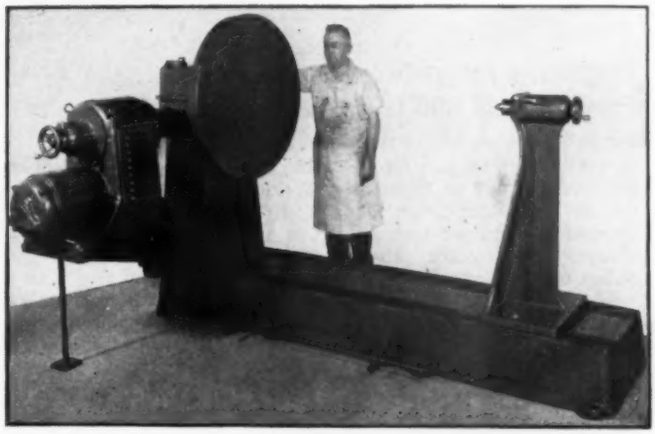
American Society for Testing Materials. Spring Meeting. Cleveland, Ohio, Mar. 4.

National Electrical Manufacturers Association. Convention. Palmer House, Chicago, Ill., February 2-5.

Society of Automotive Engineers. Annual Meeting. Book-Cadillac Hotel, Detroit, Mich. January 12-16.

SHOP EQUIPMENT NEWS





Gleason Works Introduces Precision Grinder For Finishing Generated Curved-Tooth Gears

Teeth of generated curved-tooth, bevel and hypoid gears and pinions can be finished by precision grinding on the No. 17 Hypoid grinder recently announced by Gleason Works, 1000 University Ave., Rochester, N. Y. The advantages of ground bevel gears include heat-treat distortion correction, all uniform teeth, elimination of surface irregularities, removal of tool marks, and tooth profile and fillet blended smoothly into bottom land.

In grinding a gear, the wheel is alternately fed into the work during the up-roll of the cradle and withdrawn during the down-roll. The work, in the meantime, rotates continuously so that the wheel when starting on the next up-roll, engages a following tooth. This cycle is repeated until all teeth are ground. Hydraulic movement of the sliding base to and from cutting position and a hydraulic chuck speed and ease changing the work.

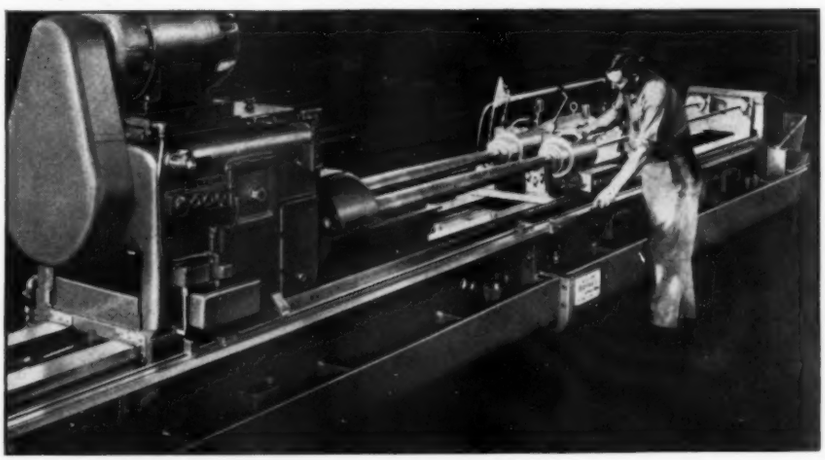
Control of tooth bearing is obtained by dressing the wheel to a modified shape and by modifying the generating roll. The dressers are hydraulically operated. The dressing is entirely automatic including advance of the wheel and dressing side, end and radius Dressers may be adjusted for feed, pressure angle, radius and wheel diameter.

Change gears control indexing from tooth to tooth and wheel speed, while cams regulate the generating roll and feed. Maximum cone distance is 12½ in.; coarsest pitch is 2½ D.P.; face width of gear can be as wide as 2½ in. and depth ¾ in. Wheels with diameters from 5¾ to 13½ in. are used.

Large Coil Winding Machine Made By Globe Tool & Engineering Co.

A large heavy duty coil winding machine with 72-in. swing was recently developed by the Globe Tool & Engineering Co., 436 Davis Ave., Dayton, Ohio. This model, CW-72, is provided with a wide range of speeds through direct-drive and back gear systems. On the standard machine the range is from 2 to 120 r.p.m. in an infinite number of steps. But higher ranges may be obtained through the back gears. Standard motor equipment is for 220-440 volts, 3 phase, 60 cycle, a.c. A 5 hp. motor is used on the illustrated machine, but others ranging from 2 to 10 hp. are available, depending on the torque requirements at the winding spindle. Full control is maintained through a foot treadle. The worm gear drive prevents uncoiling where extremely heavy tension is maintained.

Medium Caliber Gun Barrels Drilled, Bored With Barnes Machine; Two Speed Ranges



A two-spindle drilling and boring machine for medium caliber gun barrels has been introduced by W. F. & John Barnes Co., Rockford, Ill. Maximum diameter capacities are 3½ in. for deep hole boring, 3 in. for drilling from solid, and 8 in. for cylinder boring. Four models are offered with strokes up to 4, 8, 10 or 12 ft.

Deep hole drilling is performed with a two-lipped hollow drill. Chips are removed through the drill shank. Deep hole boring is performed with pack-bits. The quill provides a long guide bushing which permits starting the pack-bit directly into the previously drilled hole without boring a starting hole. Hollow spindles allow removal of pack-bit without returning them to the bores. Thus,

danger of scratching barrel is eliminated.

Spindle speeds range from 62 to 814 or from 25 to 329 r.p.m. Spindle chucks have a 12 in. maximum diameter capacity while spindle hole is 3⅝ in. in diameter. Feed rates can be regulated between ¼ and 9 in. per minute. All machines are 62 in. wide with lengths ranging from 15 ft. 4 in. for the 4-ft. machine to 37 ft. 9 in. for the 12-ft. machine.

Progressive Forge-Welder Provides Pressure to 20,000 Lb. Per Sq. In.

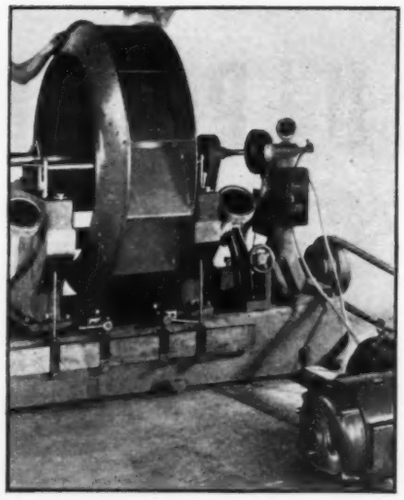
Forging pressure of 20,000 lb per sq. in. is available with the forge-welder recently developed by Progressive Welder Co., 3001 E. Outer Drive, Detroit, Mich. Pressure is obtained through the incorporation of a motor driven hydraulic pump unit. It permits welding free of

blow holes on hot rolled sections without the necessity of removing scale or rust prior to the welding operation. Included in the control system are a phase-shift heat regulator and an automatic current increase device. Forging pressure may be applied either intermittently or continuously. Welding tips can be hooked up for refrigeration.

Globe Machine Balances Parts Weighing From 50 to 1,500 Lb.

Amount and location of the correction weight required in overcoming the dynamic unbalance in rotating parts weighing from 50 to 1,500 lb. is determined by the NE-48 supersensitive dynamic balancing machine, introduced by the Globe Tool & Engineering Co., 436 Davis Ave., Dayton, Ohio. Amount of correction is recorded on the "micro-indicator" valves which are sensitive to 0.2 oz.-in. of unbalance. Angular location is shown by a neon light indicating system.

The average operator can determine corrections for a rotor in less than 1



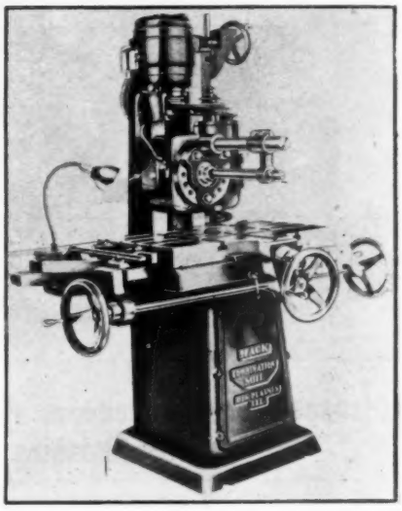
min. Unbalance in one plane is locked out while reading is taken in the other. Self-aligning ball bearings in each saddle accommodate shaft sizes varying from 1½ to 3¾ in. Shaft lengths up to 4 ft. between bearings can be handled. V-belt and vari-drive provide a wide speed range.

Small Metal, Plastic Shapes Polished by Walker-Turner Lathe

Polishing, burring and lapping metal and plastic shapes up to 2 in. in diameter can be performed with the polishing lathes introduced by Walker-Turner Co. Inc., Plainfield, N. J. Lathes are being used in the aviation industry to polish engine parts such as valves, push rods and bolts. Machine is available with either Jacobs chuck in ½ or ¾ in. capacity, or a 4 in. 3-jaw universal chuck. Pedal controls the motor switch and synchronized brake which brings the spindle to an instant stop when motor circuit is broken. Spindle speeds range from 950 to 7,200 r.p.m.

Hack Milling Machine Has Normal or High-Speed Ranges

A horizontal and vertical milling machine with fixed column has been announced by the Hack Machine Co., Des Plaines, Ill. The machine comes in both normal and high-speed models with speeds from 60 to 2,500 r.p.m. and from 1,500 to 6,000 r.p.m., respectively. Small Hack Multi-versal attachments can be used on the combination mill which is



furnished with vertical head, over-arm unit and milling arbor. Large work table is used with vernier scales. Large as well as small diameter boring operations can be performed because spindle can be operated through back gears.

120,000 Lumens Developed By General Electric Lamp

The General Electric Co., Nela Park, Cleveland, Ohio, has developed a 3,000 watt mercury lamp rated at 120,000 lumens for use in manufacturing plants. The lamp is 55 in. long and about 1 in. in diameter. Designated as G-E Mazda "AH-9" this mercury lamp will produce as much light as a system of eight or nine 400 watt mercury lamps in separate fixtures. Cost of servicing and of equipment are therefore greatly reduced. It will be particularly useful in lighting large inside areas where lofty mounting heights of luminaires are required.

Acromark Stamper Marks Parts Following Enameling

A stamping machine which will mark parts after enameling has been introduced by the Acromark Corp., 245 No. Broad St., Elizabeth, N. J. This is being used on the graduated sleeves for binoculars. In operation the hot enameled sleeve is placed on a projecting mandrel which rotates freely. The heated die bearing the graduations and numbers or lettering passes over the mandrel at each forward and at

Announcing . . .

Further Reductions in the Price of

CARBOLOY STANDARD TOOLS AND BLANKS

Effective January 1, 1942

With completion of its second plant expansion in 6 months, Carboloy Company announces its second price reduction affecting standard tools and tips since these were developed and put into mass production just slightly over a year ago.

The latest and most important expansion of the Carboloy plant has been designed to provide greater production capacity for carbide metals and tool tips. Since plant operations have been on a 24-hour, 3-shift basis for some time already, Carboloy—to take full advantage of the increased metal capacity in terms of actual tool production—is striving to convert an even greater percentage of its cutting tool and tip business from "specials" to standard tools and tips. These reductions, therefore, anticipate an expected increase in total Carboloy tool output.

The reductions affect standard tools above 3/8 inch and standard tips over 3 grams. Price reductions on blanks also affect special tools on which such blanks are used, of course. Reductions in minimum prices of typical standard tools, based on a style 1 turning tool follows:

TOOL SIZE	PREVIOUS MINIMUM	NEW MINIMUM*
1/2 sq.	$1.60	$1.50
3/4 sq.	4.20	3.50
1-1/4 sq.	9.60	7.90

**Minimum price now reached at only 5 tools on all standard tools.*

Reductions in minimum prices of typical standard blanks are as follows:

TIP SIZE	PREVIOUS MINIMUM	NEW MINIMUM*
3/32x3/8x9/16	$0.48	$0.43
3/16x1/2x3/4	1.70	1.31
3/8 x5/8x1	5.80	3.89

**Minimum price now reached at only 10 blanks on all standard blanks.*

Although Carboloy Company, fortunately, has been able to maintain deliveries on a most favorable basis, compared to the average for the cutting tool industry, it is hoped that the freeing of further "special" tool manufacturing facilities for the production of higher-output-rate "standards", will enable it to increase output to a point where 100% of standard tool shipments can be made from stock.

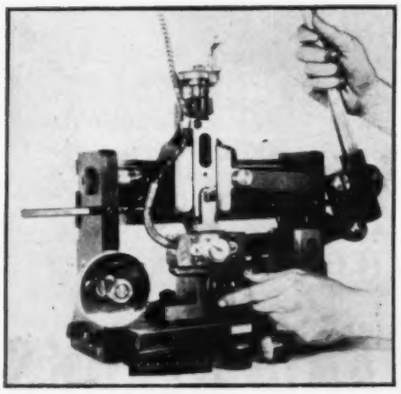
CARBOLOY COMPANY, INC., DETROIT, MICHIGAN

CHICAGO · CLEVELAND · LOS ANGELES · NEWARK · PHILADELPHIA · PITTSBURGH · WORCESTER, MASS.

Canadian Representative: Canadian General Electric Co., Ltd., Toronto, Ont.

CARBOLOY
REG. U. S. PAT. OFFICE

TANTALUM CARBIDES
TITANIUM CARBIDES
TUNGSTEN CARBIDES

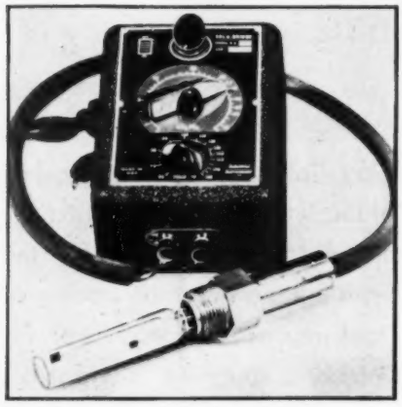


each backward stroke of the operating lever.

A roll of automatically fed white, silver or color transfer tape automatically feeds with the die furnishing the filling in the mark. The die is electrically heated. An adjusting crank regulates depth of mark. The machine can be had without electrical attachments and can be used for cold marking metal sleeves, cylinders, cups, caps, fuses, shell and other parts.

Pickling Bath Strength Accurately Tested by Industrial's Device

Maintenance of acid content is essential for the production of uniform work in pickling baths. Strength of bath can be instantly and accurately determined by the solu-bridge device developed by Industrial Instruments,

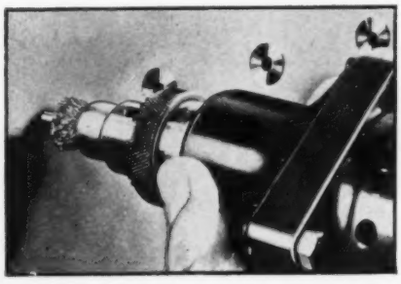


Inc., 156 Culver Ave., Jersey City, N. J. Measurements are read in terms of sulphuric acid concentration. Operator can tell directly when and how much acid must be added to maintain a given strength.

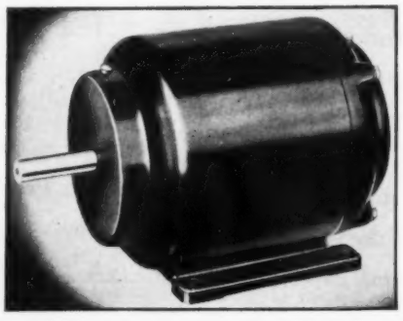
Area Around Rivet Holes Cleaned More Rapidly With Osborn Brush

Cleaning the small area around rivet holes, bolt holes, etc., has been speeded up by use of a tiny brush manufactured by the Osborn Mfg. Co., Cleveland, Ohio. It is being used principally in the aircraft industry where all internal and external metal parts of a plane are coated with zinc chromate paint. Where a good metal to metal bond is required to eliminate hazard of fire or radio interference due to static discharge, the paint must be removed from around rivet and bolt holes.

This tiny end brush made of wire and incorporating a special pilot rod to fit



into the hole can be attached to any portable tool driving unit. One man now cleans as many holes as seven men. The tool has many other industrial uses besides those in the aircraft industry.

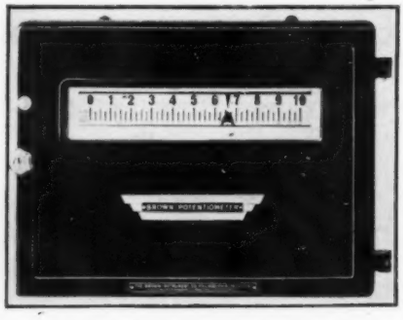


Ohio Electric Offers Motors For Use on Machine Tools

Compact, integral, polyphase motors for use on machine tools are offered by the Ohio Electric Mfg. Co., Cleveland, Ohio. Terminal box can be located at any angle on the circumference. Frame for this line of motors is 8 in. in diameter by 10⅜ in. in length. Sizes range from ½ to 2 hp. in all standard speeds.

Brown Instrument Regulates Pickling Tank Temperatures

Accurate temperature control in pickling tanks provided by the system introduced by the Brown Instrument Co.,



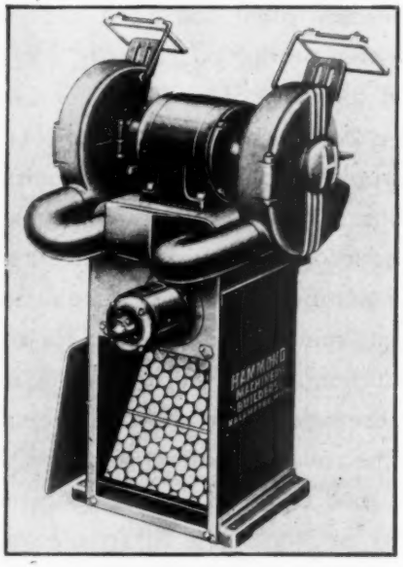
Wayne & Roberts Aves., Philadelphia, Pa., guarantees greater uniformity of pickling. Because temperatures may be duplicated for long periods of time, the actual pickling which occurs is held at an optimum level. Avoidance of high temperatures not only saves materially on steam cost, but saves material which is lost on high temperature operation.

Control unit consists of a thermocouple, indicating and controlling potentiometer, manual control station and control valve. Thermocouple detects the temperature of the bath which is indicated by the potentiometer. Inclosed mercury switches mounted in the potentiometer actuate control.

Hammond Builds Dust Collector Into Base of Three Grinders

Self-contained dust collectors have been built into 10, 12 and 14 in. grinders by Hammond Machinery Builders, Inc., 1618 Douglas Ave., Kalamazoo, Mich. Dust-collector unit is mounted inside the base. The only parts outside are the fan motor, pipes connecting wheel guides to collector and air exhaust vent guard.

The air ducts are shaped so that heavier particles are carried down into a compartment in the bottom of the

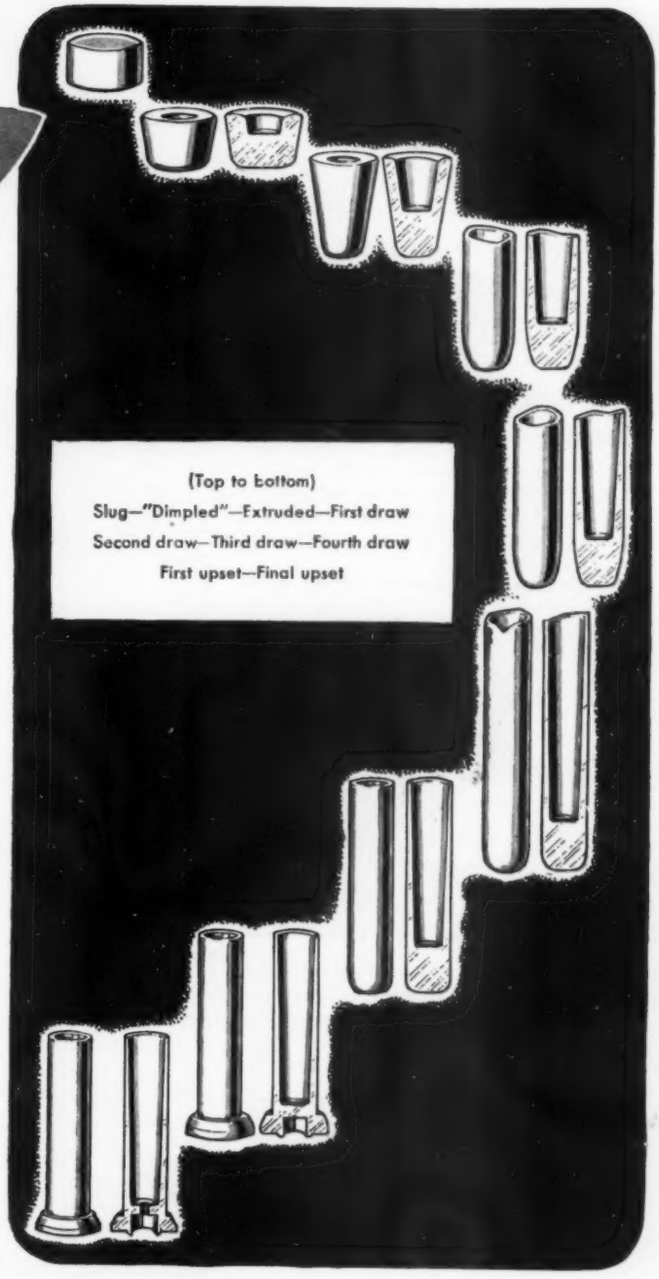


housing. Lighter particles and air go through three filters of fiber glass. Air is exhausted clean. The dust collector is also built as a separate unit for use with grinders that do not permit placing filters within the base.

Driving Tools for Plane Assembly Made by Products Engineering

Two driving tools developed for aircraft but applicable to many production, fabrication and assembly jobs, have been announced by Products Engineering Co., 700 E. Florence Ave., Los Angeles, Calif. They work with wrist or dog-leg action and have five tips for

From "vanities" to primer bodies...



when Volupte and Revere put their heads together

When Volupte, Inc., one of the leading manufacturers of compacts, wanted to use its facilities to make primer bodies for Uncle Sam, the change-over involved more than merely a shift from beauty to utility.

Everything was new. Appearance had once been vitally important. Now performance took its place. Emphasis on surface finish gave way to emphasis on ductility, uniformity, precision. The brass had to be of a new analysis, responding differently to the various operations. New equipment had to be selected, and new methods worked out.

Here was a situation full of potential "headaches" for the manufacturer, but also full of opportunity for a Revere Technical Advisor to assist in eliminating them. After calculating a temper for the brass providing the correct balance between ductility and machinability, the customer was provided with a specification which made it easy to specify materials on repeat orders. A correct method was developed for each new operation. Recommendations on sizes of stock were made, to minimize scrap loss.

Quite some time has passed since Volupte, Inc. worked out these problems with the Revere Technical Advisor. America now has a large new source of dependable primer bodies . . . a prominent manufacturer has successfully added a new type of business . . . and Revere has helped an old friend. The Revere Technical Advisors will be glad to help you with your problems. Write us.

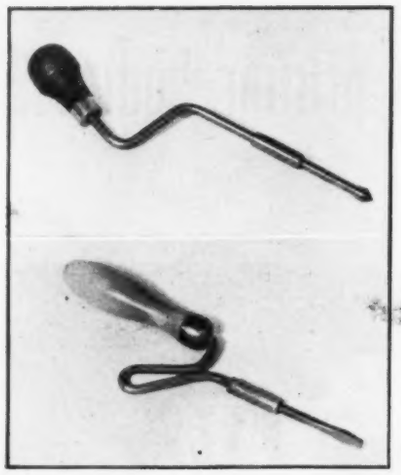
REVERE

COPPER AND BRASS INCORPORATED

Executive Offices: 230 Park Avenue, New York

Sales Offices and Distributors in most of America's major cities

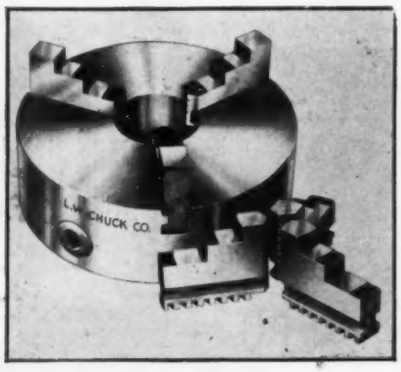
MILLS: BALTIMORE, MD. · TAUNTON, MASS. · NEW BEDFORD, MASS. · ROME, N.Y. · DETROIT, MICH. · CHICAGO, ILL.



burring, countersinking and driving. These may be snapped in or out in a second's time. Balance of these multi-utility tools assure smooth, non-slipping action at all times.

L-W Three-Jaw Universal Chuck Comes in 6, 7½, 9, 10½ In. Sizes

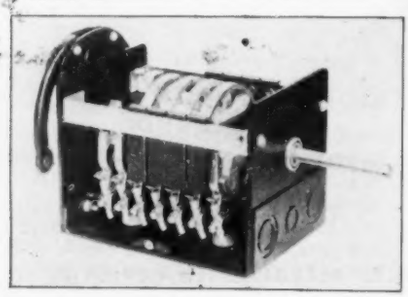
A three-jaw universal chuck suitable for either lathe or screw machine work has been introduced by L-W Chuck Co., Toledo, Ohio. Body is a semi-steel cast-



ing, with jaws hardened and ground. A set of reversible jaws also is furnished. The chuck comes in four sizes—6, 7½, 9, and 10½ in. There is a T-hand wrench included with each chuck.

C-H Drum Controllers Used With Small Cranes, Hoists

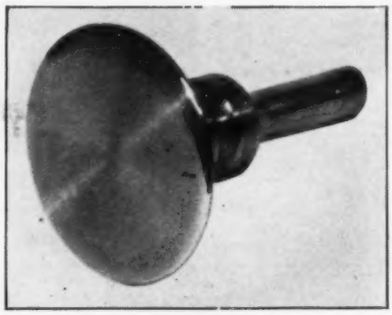
Drum controllers for small cranes and hoists are manufactured by Cutler-Hammer, Inc., 315 N. 12th St., Mil-



waukee, Wis., in self-centering rope lever, self-centering and non-selfcentering radial lever types. Available for four or six speeds, they are small and compact. Rope operating lever eliminates cumbersome sheave wheel, rope guard and external return spring. Drum life is increased by making it impossible to whip drum from full forward to full reverse position. Drum can be reversed quickly, but a definite time delay is required in the off position.

Products Engineering Rivet Sets Do Not Mar Aircraft Surfaces

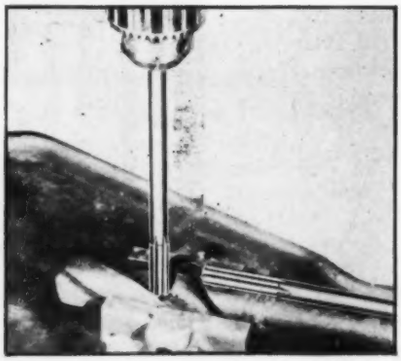
Face design of flush rivet sets, manufactured by Products Engineering Co., 700 E. Florence St., Los Angeles, Calif., eliminates dishing and marring of skins



and surfaces in aircraft riveting. Standing brazier and round head sets avoid ringing or marking when tipped to angles up to 7 deg. They are forged and ground to rigid specifications.

Black's Reamers for Hard Steels Have Exceptionally Long Life

Steel of any hardness can be reamed with the reamer made of hard steel by the Black Drill Co. 5005 Euclid Ave.,



Cleveland, Ohio. Even when used on steels with hardness greater than 35 deg. Rockwell, these reamers have exceptionaly long life. They have been used sucessfully on carburized, oil hardened, water hardened, cyanided and nitrided high speed steel.

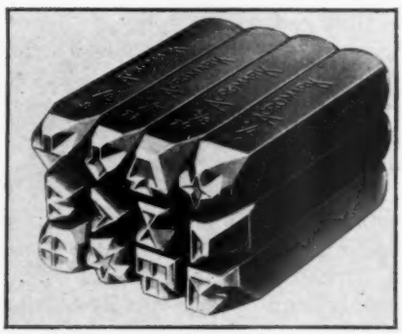
Mercury Electric Tractor Designed For Use in Low Ceiling Areas

Seat, floor, brake pedal and steering controls have been lowered and a protective metal canopy provided on the "Tug" electric tractor, manufactured by Mercury Mfg. Co., 4114 So. Halstead St.,

Chicago, Ill. These changes make the unit particularly useful in tunnel operation or where low overhead obstructions are present. Frame is of all welded steel plate construction and is suspended by semi-elliptic front and rear springs. Mechanical contactor controller provides snap-action.

Acromark Inspector's Stamps Include 100 Simple Symbols

One hundred simple symbols have been designed for inspectors' symbol stamps by the Acromark Corp., 245 North Broad St., Elizabeth, N. J. Simplicity of each



design gives maximum strength and permits an included number if used for the same operation in different inspection shifts. On the front of each stamp is the symbol identification number and size for easy reorders.

Challenge Bench Plates Made In Nine Sizes, Three Thicknesses

Small precision ground semi-steel bench plates for assembly, layout and inspection operations are available from the Challenge Machinery Co., Grand Haven, Mich. Providing an accurate

SAVE TOOLS..TIME..MATERIAL *with* SUNOCO

PERFORMANCE DATA

OPERATION — Combined drilling and facing.

MACHINE — Jones & Lamson 7A Saddle Type Universal Turret Lathe.

CUTTING LUBRICANT — 1 part Sunoco to 15 parts water.

Photo Courtesy of
JONES & LAMSON MACHINE CO.

SET A HIGH P-Q* FOR YOUR PLANT

Here's how to make a triple saving in your shop . . . and pave the way to a higher P-Q* (Production Quota). Put Sunoco Emulsifying Cutting Oil on the job!

SAVE TOOLS! Sunoco's high heat-absorbing and lubricating qualities prolong tool life . . . help keep tools sharper, longer. That's important today with high speed tool steel hard to get.

SAVE TIME! Today's production schedules demand speed. Again Sunoco proves your ally! A flood of Sunoco over tools and work permits heavy cuts at high speeds . . . faster production . . . increased output per unit.

SAVE MATERIAL! Sunoco users report savings in materials due to decreasing rejects caused by inaccuracies and faulty finishes. Sunoco puts "nth" degree accuracy on a production basis.

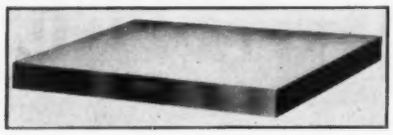
TEST SUNOCO in your own plant . . . under your own operating conditions. Call in a Sun "Doctor of Industry" for specific recommendations. It's the first step toward setting a higher P-Q*. Write to SUN OIL COMPANY, Philadelphia.

**Production Quota*

SUNOCO
EMULSIFYING
CUTTING OIL

SUNOCO

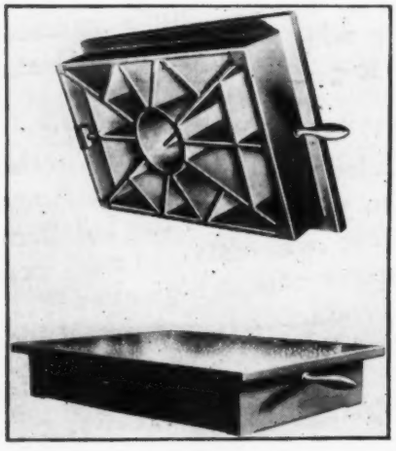
SUN PETROLEUM PRODUCTS HELPING INDUSTRY HELP AMERICA



plane surface, these plates have all sides machined at right angle to the top. Nine standard sizes, 2, 4 or 6 in. thick, are available; 8x10 in., 10x14 in., 12x12 in., 12x14 in., 12x16 in., 12x18 in., 14x18 in., 16x18 in. and 18x18 in.

Three Lombard Surface Plates Heat-Treated to Relieve Stress

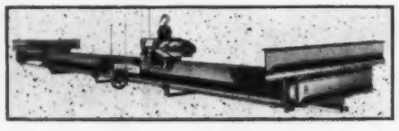
Surface plates specially heat-treated to relieve casting and machining stress, and to insure precise accurate surface after scraping, have been introduced by Lombard Governor Corp., Ashland, Mass. They are available in three sizes: 24x36 in., weighing 450 lb.; 18x24 in.,



weighing 190 lb.; and 14x18 in., weighing 95 lb. Plates are hand scraped slowly and carefully to produce a high degree of precision. Planed surface and hand lapping plates are also available. There is exceptionally heavy ribbing and plate has 3-point suspension.

Northern Auxiliary Hoist Line Made in Capacities up to 15 Tons

A line of electric hoist cranes for auxiliary use in large plants, and for main hoisting in small plants, is offered by Northern Engineering Works, Detroit,



Mich. Cranes are built in various capacities up to 15 tons. They may be had either top running or underhung, hand or motor travelled, or with cab control. Transfer and special double head types can be had.

Rust, Corrosion Easily Removed From Metals by P-M Solvent

A fast acting solvent, known as Exola, combines chemically with rust or corrosion to form a metal stearate which can be removed from metal parts without harming the metal. The product was recently announced by Patrick-McDermott Co., Los Angeles, Cal. It has been recommended for freeing metal parts badly frozen together. It is available in pints, quarts, gallons and 30 or 50 gallon drums.

TRADE PUBLICATIONS

AIR PUMPS, COMPRESSORS Gast Mfg. Corp., Benton Harbor, Mich., have released a loose leaf catalog of rotary air pumps and compressors.

ARC WELDER Publication GEA-3726 of the General Electric Co., Schenectady, N. Y., explains arc welding of aircraft tubing and thin-gage metals.

CRANE CONTROL Crane controls for hoist motors up to 330 hp. are described in a four-page leaflet announced by the Westinghouse Electric and Mfg. Co., East Pittsburgh, Pa.

DIE SPRINGS Muehlhausen Spring Corp., Logansport, Ind. have released a die spring bulletin.

FLUORESCENT LIGHTING Many illustrations of fluorescent lighting in industry are included in the 24 page booklet published by General Electric Lamp Dept., Nela Park, Cleveland, Ohio.

GAGES Plug and ring gaging is described in Bulletin No. 4122 published by Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles, Calif.

HAND PUMP Watson-Stillman Co., Roselle, N. J., has published a 4-page bulletin, No. 240-A, about hand operated high pressure pumps for testing purposes and for operating hydraulic jacks and other small hydraulic tools.

HYDRAULIC VISE Use of a hydraulic vise is thoroughly illustrated and described in a folder prepared by Studebaker Machine Co., 9 S. Clinton St., Chicago, Ill.

INDIUM The Indium Corp. of America, 805 Watson Place, Utica, N. Y., has put together a folder of information on indium.

IRON CORE DATA Facts, figures and curves dealing with the electrical and mechanical characteristics of high frequency powdered iron materials and cores have been incorporated into a loose-leaf form by Henry L. Crowley & Co., Inc., 1 Central Ave., West Orange, N. J.

LATHE A single-spindle, multiple tool lathe is described in an 8-page folder published by Frankel Machinery Corp., 118 E. 28th St., New York, N. Y.

LOCK NUTS Uses and advantages of self-locking nuts are included in a 12-page folder prepared by the Palnut Co., 61 Cordier St., Irvington, N. J.

MOTORS Bulletin MU-183 on single-phase, d. c., and small polyphase motors has been published by The Wagner Electric Corp., 6444 Plymouth Ave., St. Louis, Mo.

PATENT BACKGROUND Fifteen articles on "Patent Background for Engineers" have been reprinted in a 56-page book by Allis-Chalmers Mfg. Co., Milwaukee, Wis. The articles first appeared in **Electrical Review.**

PORTABLE TOOLS Catalog No. 37 describing portable electric tools has been released by Independent Pneumatic Tool Co., 600 West Jackson Boulevard, Chicago, Ill. Many illustrations of tools and operations are included.

PROTECTIVE COATINGS A 42-page catalog of protective coatings has been published by Protective Coatings, Inc., 10391 Northlawn, Detroit, Mich.

SANDER An endless belt sander has been described in a leaflet put out by Jefferson Machine Tool Co., Fourth, Cutter and Sweeney Sts., Cincinnati.

SCAFFOLDING Steel scaffolding equipment is listed in a catalog recently prepared by Mechanical Handling Systems, Inc., 4600 Nancy Avenue, Detroit, Mich.

STANDARDS INDEX The American Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa., has issued its annual index to A.S.T.M. standards.

TEMPERATURE CONTROLS A condensed catalog of control instruments for temperature regulation has been issued by Wheelco Instruments Co., Harrison and Peoria Streets, Chicago, Ill.

TRANSMISSION A 52-page catalog and data book, No. 1874, describing variable speed transmission units of ½ to 15 hp. capacity, has been released by Link-Belt Co., 307 N. Michigan Ave., Chicago, Ill.

WELDER SWITCH Booklet B-3025 published by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., describes a power switch for use with resistant welding machines.

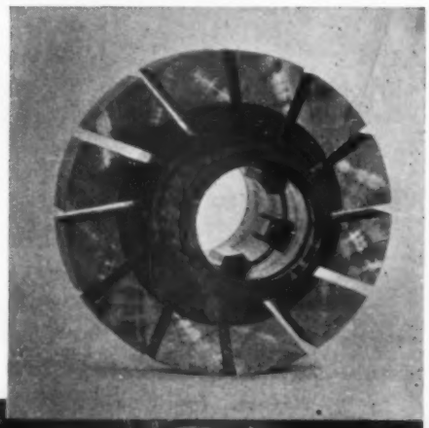
ZINC SUBSTITUTE "Substitution of Paint Coatings for Metallic Zinc Coatings", prepared by E. F. Hickson, chemist, National Bureau of Standards, has been published by the Specifications Branch, Bureau of Industrial Conservation, Office of Production Management, Washington, D. C.

"TOOL ROOM" PRECISION in PRODUCTION by Broaching

THE JOB: To put machining of pump rotor slots on production basis.

THE METHOD: Broaching two slots at a time in two passes.

THE RESULT: Lower cost per piece, fewer machines, tool room precision in production.



BROACHING PAYS IN JOB LOTS..No. 5

FACED with the problem of stepping up rotor production for precision hydraulic pumps from a-few-at-a-time to a capacity of several thousand per month, broaching was found to provide the answer to low-cost production accuracy.

On a job-lot basis, these slots —only about 5/64 inch across —are held to plus or minus two and one half ten thousandths with greater ease and uniformity by broaching than it was possible to hold the same parts, a few pieces at a time, by milling.

Even if the job could be done as well, it would have taken quite a few milling and drilling machines to do the same job as the single two-broach equipped Colonial.

More details on this operation are to be found in the current issue of "Broaching News". We'll be glad to send you a copy. Ask for issue No. 10.

COLONIAL BROACH COMPANY *147 JOS. CAMPAU ST. DETROIT, U. S. A.*

(Advertisement)

Manufacturers Look to Steel Warehouses for Quick Defense Requirements

Many leading manufacturers are relying on nearby steel-service plants for prompt stock shipment of steel to meet the current surge of business prompted by Washington's defense program.

Probably the leading exponent of "Immediate Steel" is Ryerson with a net work of ten strategically-located plants, each of which has large and complete stocks of steel and allied products. In addition, each plant is equipped with complete forming and cutting facilities so steel can be prepared to customer's exact requirements. No shop should be without the Ryerson Stock List (see advertisement below).

Thousands of manufacturers report saving considerable time, trouble and money by taking advantage of Ryerson's complete flame cutting service. Modern equipment manned by specially trained operators can quickly burn any shape—no matter how intricate—from carbon or alloy steel plates and billets up to 15" thick.

Beginning the 100th Year of Ryerson Steel-Service

Large and complete stocks, steel of known quality, prompt and dependable service.... these are the rugged cornerstones on which the Ryerson business has been built. 100 years of experience is at the disposal of Ryerson customers to help them meet every steel problem. Today, our stock in many lines is depleted and war needs have the right of way. However, we continue to serve every customer to the best of our ability in accordance with the Government Program. Joseph T. Ryerson & Son, Inc., Chicago, Milwaukee, St. Louis, Cincinnati, Detroit, Cleveland, Buffalo, Boston, Philadelphia, Jersey City.

RYERSON STOCKS
includes:
Beams and Heavy Structurals
Channels, Angles, Tees and Zees
Rails, Spikes, Bolts, etc.
Plates and Sheets
Hot Rolled Bars, Hoops and Bands
Cold Finished Shafting
Alloy and Tool Steels
Heat Treated Alloy Steels
Strip Steel, Flat Wire, etc.
Stainless Steel
Mechanical Tubing
Boiler Tubes and Fittings
Welding Rod, Wire
Rivets, Bolts, Nuts, Washers, etc.
Concrete Reinforcing Bars
Babbitt Metal and Solder

RYERSON CERTIFIED STEELS

RYERSON

SEEN and HEARD

By JOHN R. GODFREY

Taps for Gages

Suggestion boxes bring out a lot of ideas, many of which cannot be used. But the other day a large company found one it thought was worth $75—and they paid it to the suggester.

As with many shops under the present stress, they have had a lot of trouble getting thread gages. But they have had little trouble with orders for taps. And all taps are carefully inspected as soon as received. So one bright tool maker suggested taking taps that were O.K., grinding off the cutting edge, and using them for thread gages. It's been working out very well. Perhaps others may find it useful.

That Ain't Hay

One of the new defense plants passed this story along to us for what it may be worth. Recently a farm boy came down from the hills, was given an intensive course in machine operation and put to work. After six weeks in the shop, he approached his foreman and asked when he would be paid.

"Haven't you been getting your pay check with the rest of the boys each payday?" said the foreman.

"They gave me some slips of paper telling me what I earned, but I want to know when I'll get my money."

"What have you been doing with those slips of paper?" asked the foreman.

"Tore 'em up," replied the boy.

---

50 Years Old or 400?

By PAUL GRODZINSKI

Lathe chucks for turning ovals, recently described by Fred H. Colvin (*AM*—Vol. 84, page 1058), reminded me that the principle applied in this chuck is much older than 50 years—400 years may not be far off the mark.

The first more or less accurate drawings of such a device will perhaps be found in the remarkable book of Monsier Charles Plumier, a Franciscan monk: "L'Art de Tourner ou de faire en perfection toutes sortes d'ouvrages au dans lequel," written in French and Latin, illustrated with numerous full size plates, and published in 1706 in Paris. Leonardo da Vinci also made a sketch of such a device. If this is true, and Plumier's book so indicates, then it can be safely said that the invention of the oval chuck was made about 1500.

The principle of all the elliptical turning devices seem to be basically the same—the cinematical inversion of the well-known elliptical circle with two slides crossed at 90 deg.

Cutting Speeds Compared

Frequently the relative cutting qualities of molybdenum and tungsten high-speed steels are discussed. This is truer today than in past years because of the government mandatory order providing for the purchase by users of cutting tools of molybdenum and tungsten high-speed steels in equal quantities. During one such discussion, a manufacturer of machine tools, who had been using tungsten steels exclusively, advanced the following comparative data on the two types of steels:

HIGH-SPEED STEELS*

Depth of cut, in.	Feed per revolution, in. 1/64		1/32	
	Surface speed, ft. per min.			
	Mo	W	Mo	W
1/16	98	80	87	70
1/8	83	72	73	63
3/16	62	65	56	53
1/4	51	59	47	53
SUPER HIGH-SPEED STEELS**				
1/16	113	97	102	88
1/8	97	87	87	78
3/16	74	78	68	70
1/4	58	72	54	65

NOTES:

Numbers under Mo and W are the cutting speeds for molybdenum and tungsten high-speed steels, respectively.

These data are for continuous cutting with lubricant on SAE 1045 steel.

** Composition of the molybdenum high-speed steel: Carbon—0.65 to 0.82 percent; chromium—4.00; vanadium—1.10; tungsten—1.50; molybdenum—8.25. Composition of the tungsten steel: Carbon—0.55 to 0.75 percent; chromium—4.00; vanadium—1.00; tungsten—18.00.*

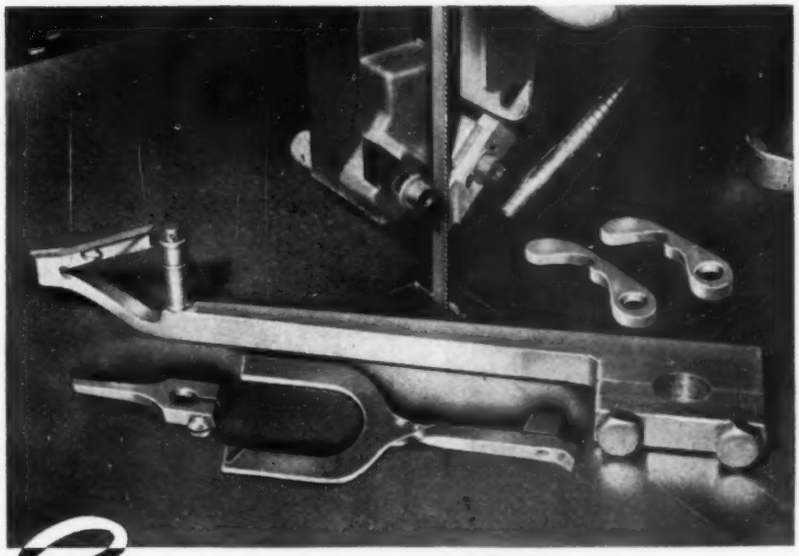
*** Composition of the super molybdenum high-speed steel: Carbon—0.78 percent; chromium—4.00; vanadium—1.25; tungsten—1.50; molybdenum—8.50; cobalt—5.00. Composition of the tungsten steel: Carbon—0.70 percent; chromium—4.25; vanadium—1.25; tungsten—18.00; molybdenum—0.50; cobalt—5.00.*

No attempt was made to interpret these data, although it is interesting to note that for the 1/16-in. cuts the SAE 1045 steel was machined an average of 19½ percent faster with the molybdenum steels than with the tungsten steels. For the ¼-in. cuts this condition in favor of the molybdenum high-speed steels was reversed—the tungsten steel providing 18½ percent faster cutting speed.

Odd Use for Cellophane

During a recent visit to an aircraft factory, operators of large hydraulic presses were observed placing sheets of cellophane over sheet metal before forming the part. The production department had recommended this procedure as an aid in the elimination of wrinkles and cracks while drawing the metal. Furthermore, when the ram was raised, there was no tendency for the die to stick to the formed part.

Although this was the original inten-



Easy as PIE FOR DoALL SAWS

Yes Sir, they go right through any kind of metal or alloy with a speed and smoothness that is astonishing.

Above parts, formerly cut by hand, are now sawed on the DoAll without blueprints, for an automatic paper file folding machine at Linder Mfg. Co., Minneapolis. Savings in time are tremendous, according to Mr. Linder.

And, not satisfied with cutting ordinary metals, DoAll Saws do a real job on such tough ones as cold rolled nickel, laminated low carbon sheet steel, Neoprene, aluminum alloy, bronze, semi-steel castings, etc.

FREE BOOKLET

"Actual Performance Records of DoAll Saws." Send for copy. It's short and interesting.

Available in various lengths, each saw comes in a patented metal box, with a slot for saw to be pulled out and cut off as required.

42 STANDARD SIZES

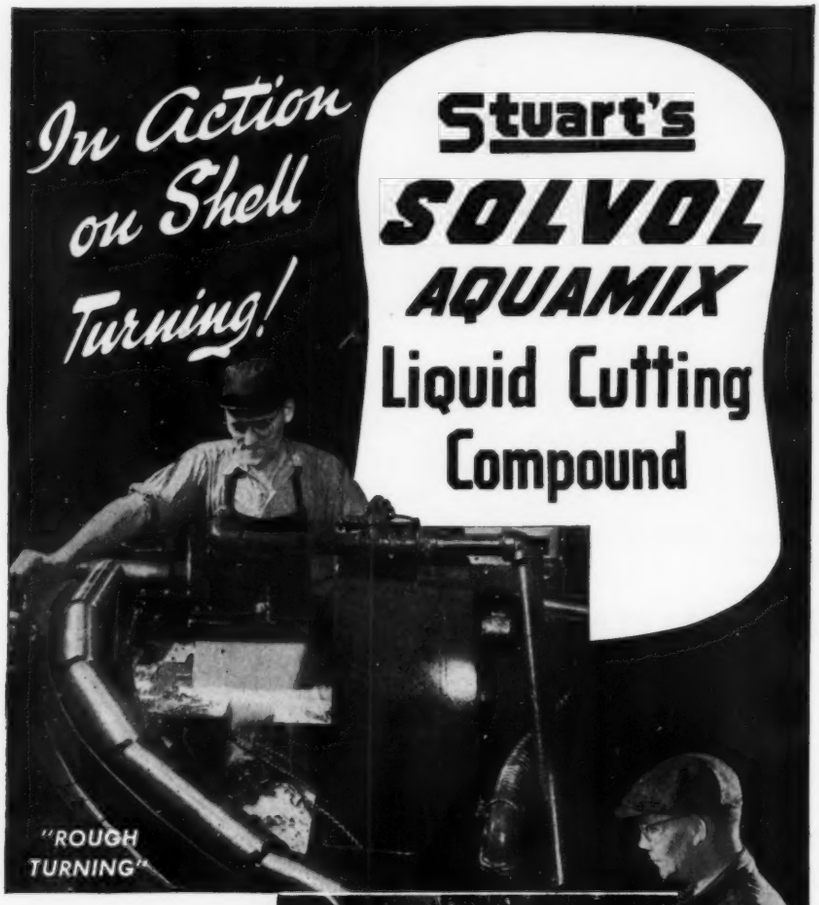
DoAll Band Saws come in every size approved by the OPM, in Raker tooth, heavy set, A temper.

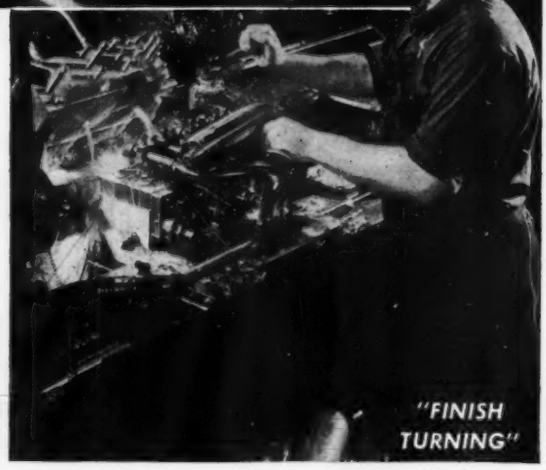
THE DOALL COMPANY

1210 THACKER ST., DES PLAINES, ILL.

Associated with Continental Machines, Inc., Minneapolis

DO ALL SAWS





Photos Courtesy of International Harvester Company

Highspeed SHELL TURNING with *cemented carbide tools* and scores of other tough metal-working operations function better with this genuine new development.

Stuart's Solvol Liquid Cutting Compound, unique in the field of tool lubricants, is already in wide use at many of America's largest and best known munitions plants. It is solving cutting problems and definitely doing its part in speeding up production. Try it quickly and benefit by the obvious improvement and economy.

• • •

Wire for production sample — free to any concern working on defense

For All Cutting Fluid Problems

D. A. STUART OIL CO.

Chicago, U.S.A. • LIMITED • Est. 1865

Warehouses in All Principal Metal Working Centers

tion of the production department, it was found that the part was formed without scratches. This is important in the production of pressed parts of wing and fuselage structures, and as a result all parts formed in the presses are now first covered with cellophane sheets.

The tensile strength of cellophane is remarkable, and one sheet can be used several times before it ruptures. Ruptured sheets are salvaged for the production of smaller parts.

Slip-Proof Machine Platforms

For the convenient operation of large machine tools it is often necessary to provide working platforms. Such platforms are frequently made of corrugated steel but even this material becomes slippery when it is wet with cutting lubricant.

For this reason the safety engineer of a company, which has built a large plant for armament manufacture, found it necessary to redesign the platforms furnished for a battery of large boring mills by cutting them down and applying a wood-block surface. This change reduced the slipping hazard to a negligible factor. In order to avoid the cost of such changes it would seem to be a sound idea to furnish a working surace other than steel with the original equipment especially where it cannot be kept free from oil.

Trend to Salt Baths

Some of the most significant developments in the field of heat-treating during 1941 were made possible by the immersed electrode salt bath furnaces such as developed by the Ajax Electric Company. Heavy production of shells heated for nosing, together with the hardening of armor-piercing projectiles, is carried out today in fully mechanized salt baths.

The salt bath process is said to have shortened the usual two-hour time cycles to a quarter or a sixth the time required previously and has enabled armament makers to use the salt bath process under scientific conditions, thus gaining the required high physicals in the metal without decarburization and scale.

Armor-piercing shell hardening units are built so that projectiles may be selectively hardened at the nose only. This prepares for specification changes which are fully anticipated by those now making or preparing to make solid steel shell. It seems apparent that the present three-piece shell (including cap and windshield) will be simplified to one-piece production.

Using a liquid carburizing process at 1750 F., the Breeze Corporation is enabled to maintain a high volume of production on face-hardened armor plate for aircraft crews. An exceed-

ingly deep case is produced without distorting the plate—a case deeper than ever before accomplished, even experimentally, with the liquid bath process.

Another milestone has been passed with the discovery that homogeneous armor-plate—that is, plate hardened through and through—is now practicable on a mass-production basis, using furnaces similar in most respects to those for hardening steel shell.

The interesting electric salt bath process, known as simultaneous brazing and carburizing, was first developed in Ajax furnaces during 1941. Production-scale installations for its application to the brazing of caps to chemical shell are already on the drafting boards, worked up from existing batch-type furnaces now being utilized.

Electric salt baths of the immersed electrode type are found in virtually all major producing aircraft factories. Such operations include carburizing and neutral hardening aircraft and engine parts; age hardening and solution treatment of big aluminum alloy sheet, sections, shapes and rivets; cyanide hardening and drawing; hardening and reheating supercharger and carburetor components.

The largest immersion heat-treating salt bath furnaces ever installed are the nitrate baths for the big aircraft plants. For example, the Buffalo plant of Curtiss-Wright Corporation is using such furnaces for heating aluminum alloy sections, forgings and sheet Temperatures of 940 F. prevail. Much larger units are now being built for special government-owned factories.

Infra-red Photographs of Welds

The value of infra-red photography was pointed out by William Tiffin, assistant professor of mechanical engineering, University of Oklahoma, before the recent meeting of the American Welding Society. Photographs made with white light as the source of illumination have hitherto been considered sufficient to serve as permanent visual records of the actual structure of the cross-sections of weld specimens. Such photographs show excellent detail illustrate features, which have been previously emphasized by acid etching of the specimen, and are comparatively economical and easy to produce.

The success which infra-red photography had in the medical and other scientific fields led to its consideration as a method for securing improvement in the photography of weld specimens. Prof. Tiffin noted the following advantages in the use of infra-red photography: greater contrast between weld metal and metal adjacent to the weld; better definition of the zones within and adjacent to the weld that are affected structurally and chemically by the heat of welding; and a clearer definition of the outlines and extent of defects and impurities.

Make TIME SPACE LABOR Count

"CONVEYORIZE" Your Handling...

Saving valuable time—using plant space more effectively—releasing manpower for more productive work—Standard Conveyor engineers have proved these benefits for hundreds of manufacturers—and can do the same for your company. Here are typical examples:

". . . found that we saved 150% of the cost of the conveyor in handling this one cargo of pulp as against the cost of unloading previous cargoes."—from the report of a prominent paper mill.

"We believe that due to the present arrangement of our compound department, including conveyors, we have gained approximately 65% floor or storage space, and showed a saving in handling costs of 56%."—a nationally known rubber manufacturer.

". . . one of the greatest time and labor saving devices we have ever used—paid for itself in less than 12 months."—statement of prominent food manufacturer.

". . . we selected your type of roller conveyor . . . because we felt that the contour of your steel roller is very favorable to the transportation of shells which have a finish turned copper band on them. The concave roller gives the band a two-point contact and consequently reduces the liability of damage by over 50% over what it would be if the rollers were straight or just slightly concave."—report from large armament plant where Standard Conveyors are used for fast, safe "line" production of 3 inch A. A. shell.

Call In a Standard Conveyor Engineer

—Check with him to see how Standard Conveyors can aid you to make men and machines more productive in your plant. Write for bulletin AM-1 "Conveyors by Standard"—a valuable reference book on conveying, containing data on many representative installations.

STANDARD CONVEYOR COMPANY

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FIRST FOR FASTER PRODUCTION

"THE STANDARD OF VALUE"

Standard CONVEYORS

HERE'S a way to put your plant in better shape for increased output in 1942—with *present* machines and equipment: Call in a Gulf engineer and let him work with your plant men to improve lubrication practice. For the proper application of the right lubricants is a vital requirement for maximum production — it helps to insure full capacity performance from machines — and freedom from breakdowns and mechanical troubles.

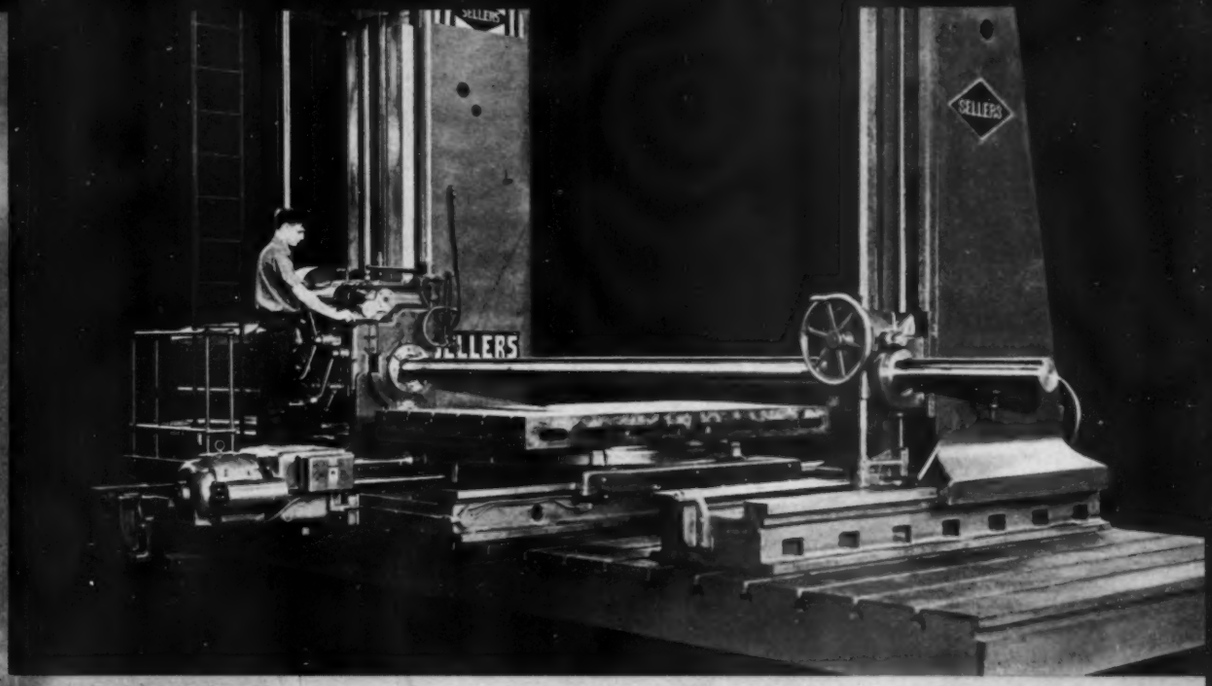
You can depend upon Gulf Engineering recommendations—they are based upon thorough technical knowledge and broad practical experience in the field—and they are backed by a large and competent research organization with the most modern research facilities, which constantly adds fresh knowledge of lubricants and their application to Gulf's vast fund of information—gained through 38 years active experience.

Begin now to get the many benefits of Gulf Engineering Service, which is quickly available in 30 states from Maine to New Mexico. Write or 'phone your nearest Gulf office today.

GULF INDUSTRIAL LUBRICATION

GULF OIL CORPORATION · GULF REFINING COMPANY

Gulf Building · Pittsburgh, Pa.

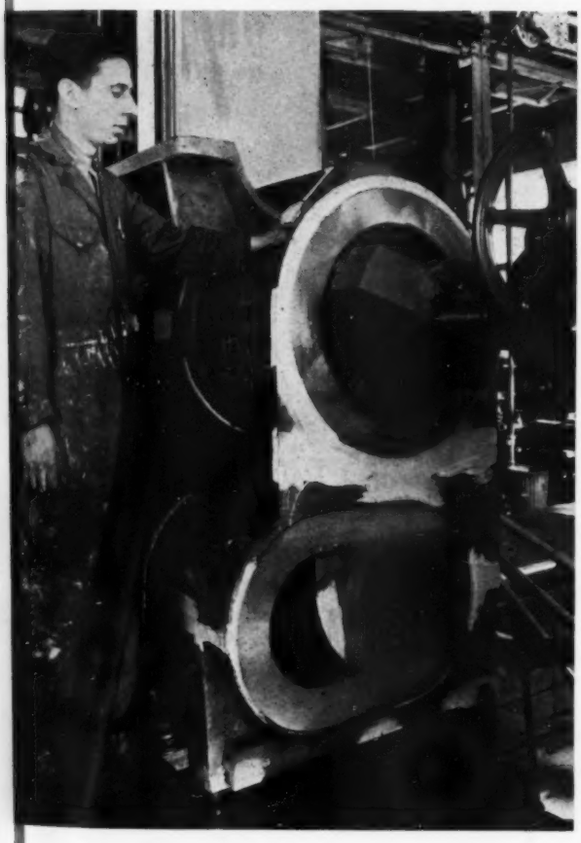


A Sellers 6" Floor Type Horizontal, with Special Revolving Table, for heavy, accurate work. Installed in one of the country's leading shipyards.

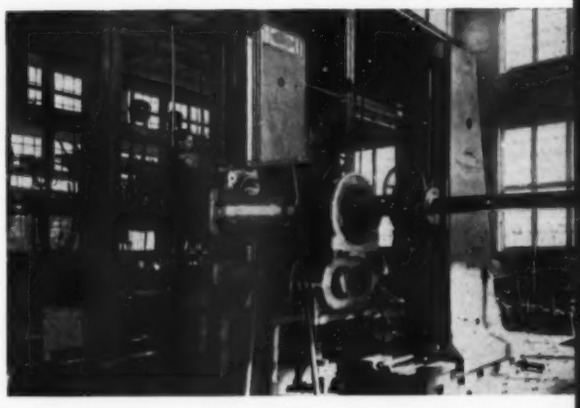
Sellers Horizontals

ACCURACY PARAMOUNT

SELLERS HORIZONTALS, like all other Sellers Tools, have been, for nearly a century, an integral part of the industrial forces that have made, and are still making America. In this time, Sellers Machine Tools have played an important role in the productive activities of Locomotive Builders, Railroads, Steel Mills, Navy Yards and Shipyards, Manufacturers of Electrical Equipment, and many other producers of vital equipment.



With all-out production for war. Sellers Horizontals and other machine tools are rendering a vital service in keeping with the traditional role of this company in time of war.



WILLIAM SELLERS & CO., INCORPORATED
1610 Hamilton Street **Philadelphia, Pa.**

FOUNDED SELLERS 1848

Sellers

Our Mutual Task

THERE can be no better time than this beginning of 1942 to thank our customers for their unfailing patience and the consideration they have shown in the past twelve months toward our efforts to supply the myriad emergency demands for steel.

Today you as consumers and we as producers of steel have a mutual task of achieving the maximum output of materials for war. We must also produce materials for the indispensable minimum of goods for our domestic economy.

The coming of active warfare has made our mutual task as the year opens increasingly arduous. Bethlehem is exerting the utmost effort to meet unprecedented demands. It is our purpose to serve our Government to the utmost of our ability in this emergency. More than 800,000 tons of steel capacity has already been added, together with accompanying increase in coke ovens and blast furnaces, and expansion of finishing facilities. Further expansions in ingot capacity, and in rolling mills, forges and shops, are anticipated. We are purchasing a wide variety of materials from more than 10,000 suppliers. Our employment rolls have been stepped up to more than 180,000.

With all of this, the demand for our products continues unabated, and 1942 will continue to require the full cooperation and understanding between steel maker and steel user.

It is a gratifying and typical characteristic of American industry that all the needs of our Government and of our national purpose have been met on all sides during the past year with vigor and cheerfulness.

Now is added a still greater and unremitting determination. We know that there will be the whole-hearted cooperation of all, so that what needs be done, shall be done.

"Enough, if something from our hands have power,
To live, and act, and serve the future hour."

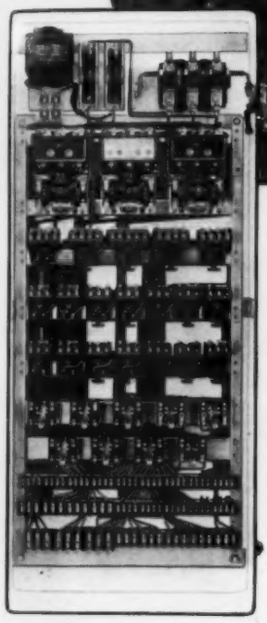
BETHLEHEM STEEL COMPANY

BETHLEHEM STEEL

SPECIAL CONTROL PANELS BUILT WITH A-B STANDARD SOLENOID UNITS

Multi-motored machine with special control panel mounted as integral part of machine

Cover removed from control enclosure to show neat appearance and handy terminals

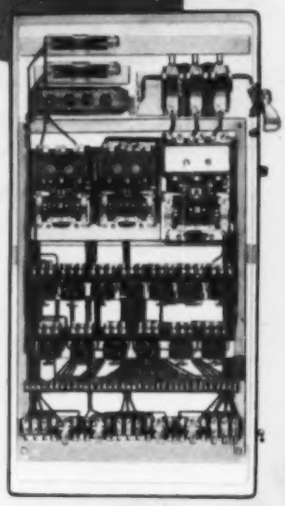


22-Unit machine tool panel.

Get More Output with Automatic Control

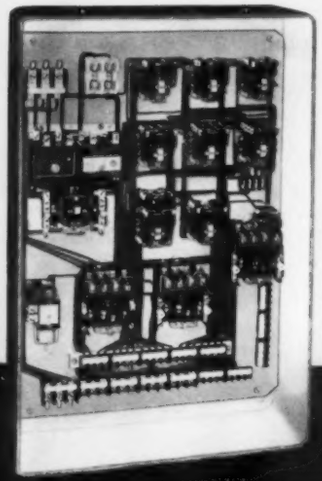
Step up the output of your multi-motored machines with tailor-made, fully-automatic sequence control. Use Allen-Bradley special control panels, assembled from standard units, and thus get any combination of sequence control without costly, experimental design.

Allen-Bradley control engineers have wide experience in such "special" panel design. Moreover, all A-B switches are standard units with long records of successful service. Don't risk the reputation of your machines with untried or more complicated controls. Specify A-B.

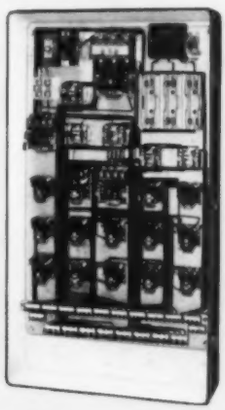


16-Unit machine tool panel.

12-Unit control panel.

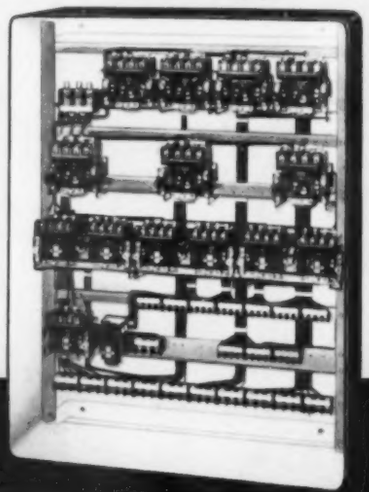


Exterior of control panel showing disconnect switch operated from front of panel.



Open view of 17-unit control panel. Note the convenient terminal connections.

15-Unit tailor-made panel.



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MOTOR QUALITY CONTROL

Made in 5 Sizes up to 50 Hp, 220 V 100 Hp, 600 V

The Allen-Bradley Family

of ACROSS-THE-LINE SOLENOID STARTERS

Did you ever see a finer looking family of motor starters? And such simple design! From smallest to biggest they are alike in attractive appearance, which makes them mighty popular with machinery builders.

With only one moving part . . . with double break, silver alloy contacts . . . with precision overload relays, this family of solenoid starters is leading the parade with a new standard of motor control performance.

Let us send you the "Story of the Solenoid Starter."

Allen-Bradley Company, 1314 S. Second St., Milwaukee, Wis.

STANDARD ENCLOSURES FOR EVERY SERVICE

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For corrosion-proof service

For water-tight service

For non-hazardous dusts

For non-corrosive hazardous gases

For corrosive hazardous gases

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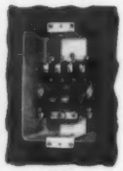
For wall mounting



For pedestal mounting

ALLEN-BRADLEY

SOLENOID MOTOR CONTROL

QUALITY

Cut Down Rejections with

MASONITE DIE STOCK

• *Masonite Die Stock used as assembly fixture and drill jig for leading edge of airplane wings manufactured at the Vought-Sikorsky Aircraft Division, United Aircraft Corporation, Stratford, Connecticut.*

More speed—less cost—fewer rejections!

Assembly fixtures are being produced in a fraction of the time formerly required by using the new and improved Masonite Die Stock. The speed with which it may be worked plus its comparative light weight and high strength are some of the reasons the experienced aircraft builders specify Die Stock for this purpose. Drill bushings may be inserted where desired to combine assembly and drilling in the same operation.

Masonite Die Stock is only about one-sixth the weight of steel . . . is easily produced in the pattern shop with high-speed wood-working tools. *This semi-plastic material eliminates the scratching of aluminum alloys, thereby cutting down on rejections.*

Dies made of Masonite Die Stock are also being welcomed into many other industries that work with thin gauges of stainless steel and aluminum or magnesium alloys, in sheet form.

Masonite Die Stock is available in thicknesses of ¼″ to 2″ . . . in sizes of 48″ x 72″ and 48″ x 144″. For further particulars, just fill out and mail the coupon.

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MASONITE CORPORATION

Dept. AM-1, 111 West Washington Street, Chicago, Illinois

Please send me illustrative literature and complete information about Masonite Die Stock.

Name and firm _____

Address _____

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LET PEERLESS SAWS HELP YOU MAKE '42 AN "ALL-OUT" PRODUCTION YEAR!

PERFORMANCE REPORT "A"

Cutting SAE, X1335, 5½" x 5½" Billets for 155 mm shell forgings in a large drop forge plant*. After cutting accurately to 15" lengths the shell stock is forged in a rotating type, gas and oil fired furnace. Seven 14" x 14" Peerless High Duty Hydraulic Saws are used. 1500 to 2000 sq. in. are cut with a single blade.

**Name on request.*

There needn't be any bottle-necks in your production program when it comes to sawing metal. Peerless Saws speed up metal cutting the safe, accurate way.

Billets . . . tool steel . . . tubes . . . aluminum . . . stainless . . . rounds or squares, in fact any shape, any analysis can be cut at higher speed and with maximum safety for the operator, the material, and the machine when the Saw is a Peerless.

Peerless is the only saw with a Four-Sided Saw Frame — the frame that completely surrounds the blade and the work . . . holds the blade with a tension and rigidity never before possible . . . prevents bowing . . . permits blade to lift and to clear on every return stroke . . . and thereby lengthens blade life.

Get the facts on the entire Peerless line — use the coupon below.

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METAL SAWING MACHINES

PEERLESS MACHINE COMPANY, Dept. AM-142, Racine, Wisconsin

Mail cutting time estimate for.....

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☐ Mail catalog on Mechanical type Saw for production cutting
☐ Mail catalog on general utility and maintenance Saws

Company.....

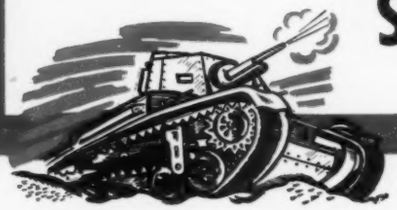
Individual.....

Street.....

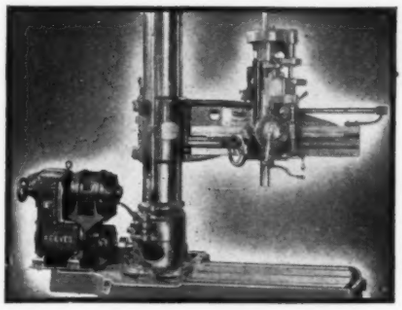
City.....State.....

FAST, ACCURATE CUTTING DEMANDS POSITIVE BLADE CONTROL

SPEED OF A *Machine* MAY BE AS IMPORTANT AS THE SPEED OF A *Tank!*



● ***When a machine has Complete Speed Flexibility, you can quickly break through to new objectives in defense production . . .***

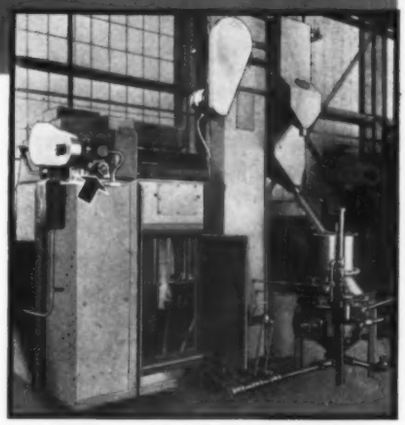


DRILL PRESS EQUIPPED WITH REEVES MOTODRIVE

Size of drill, gauge and hardness of metal —*all* influence the speed at which a drill press should be operated, for best results. Presses with inadequate speed control are obviously limited in capacity and variety of work. On the other hand, the radial drill press as shown above, rebuilt by the Louis E. Emerman Co., Chicago, and equipped with a REEVES Vari-Speed Motodrive, is so versatile and flexible it is running continuously in a big armament plant. The "switch over" from one job to another is effected merely by turning a handwheel. The exact speed is so easily attained that REEVES-equipped machines are widely preferred by management and operators.

CUTS TIME FROM 60 HOURS TO 42 MINUTES

This spar milling machine (above) with REEVES Transmission and Electric Remote Control, built by Farnham Manufacturing Co., Buffalo, N. Y., now does in 42 minutes work that used to require 60 hours. On each spar milled, the section varies from end to end. By means of the REEVES Transmission the feed can be adjusted to conform to the various sections and optimum results can be obtained at all points, gradually and without stopping the machine. On high speed milling any jerk in the feed damages the cutters, which run at 3500 r.p.m. with feeds up to 240 inches per minute.



NEW RECORDS SET IN CLEANING SHELLS

Munition shells are blasted with abrasives to clean thoroughly exterior and interior surfaces and, naturally, the speed of the conveyor carrying the shells through the machine must be accurately timed for different shell sizes. This new American Foundry Equipment Shell Blasting Machine is accordingly equipped with a REEVES Vari-Speed Motor Pulley which provides any speed desired and new records for fast processing. No changing of gears, belts, or pulleys is necessary.

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NEED HELP? This company maintains a nation-wide staff of factory-trained speed control engineers, located in strategic industrial centers. Their advice and counsel is offered, without obligation, to help speed our defense program. Write, wire or phone REEVES PULLEY CO., Columbus, Indiana.

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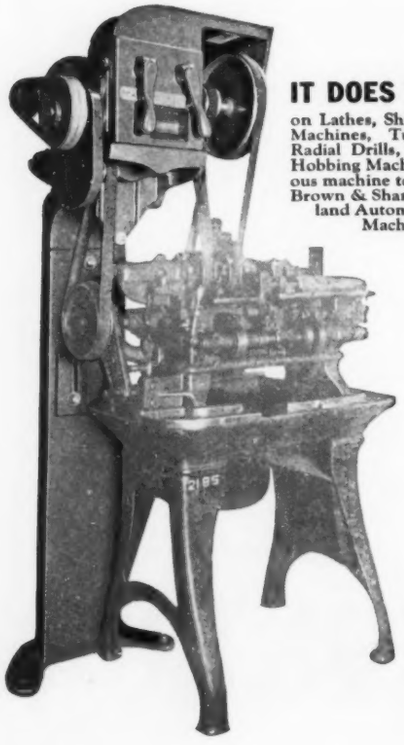

IT DOES THE JOB

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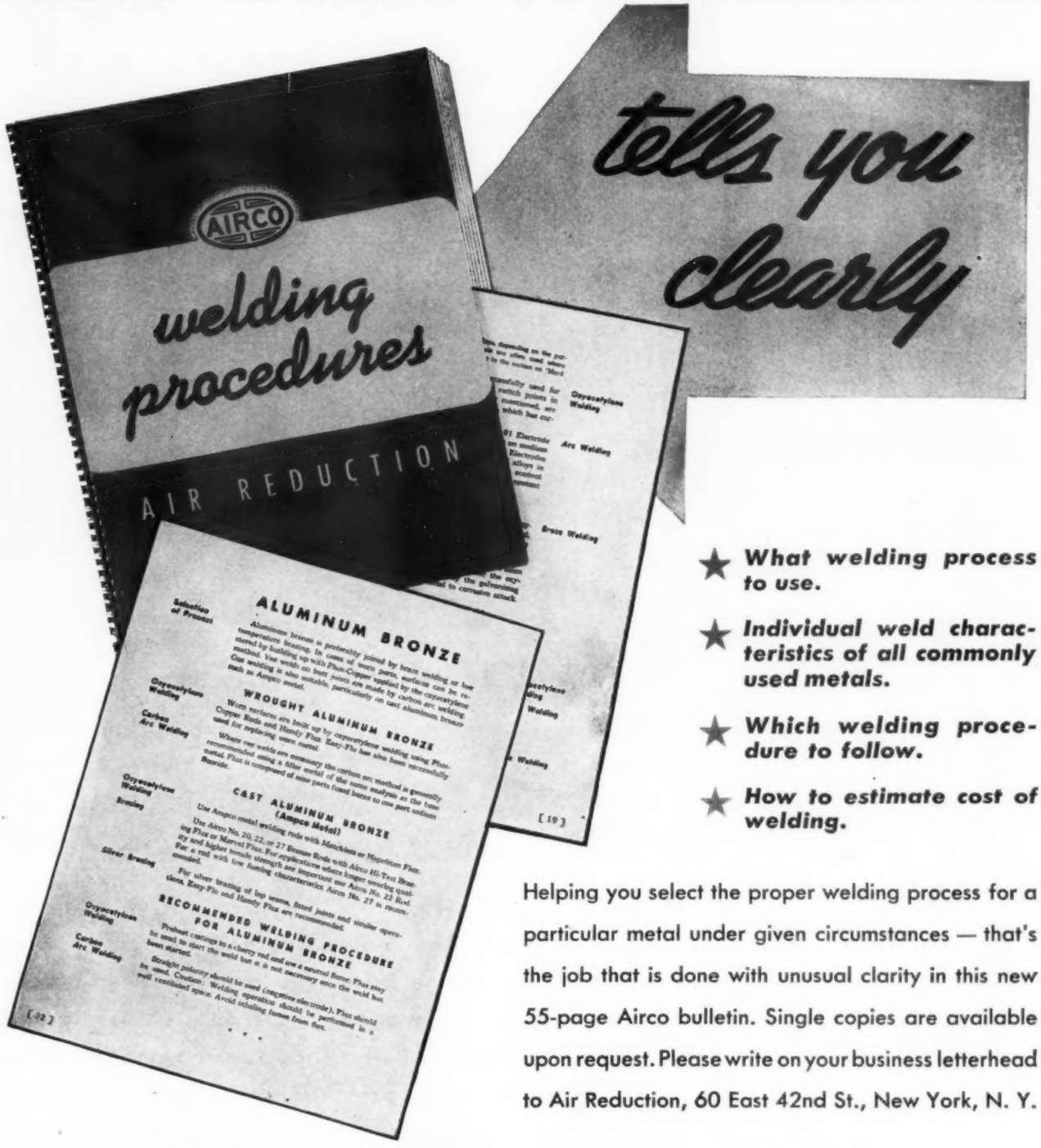

- ★ ***What welding process to use.***
- ★ ***Individual weld characteristics of all commonly used metals.***
- ★ ***Which welding procedure to follow.***
- ★ ***How to estimate cost of welding.***

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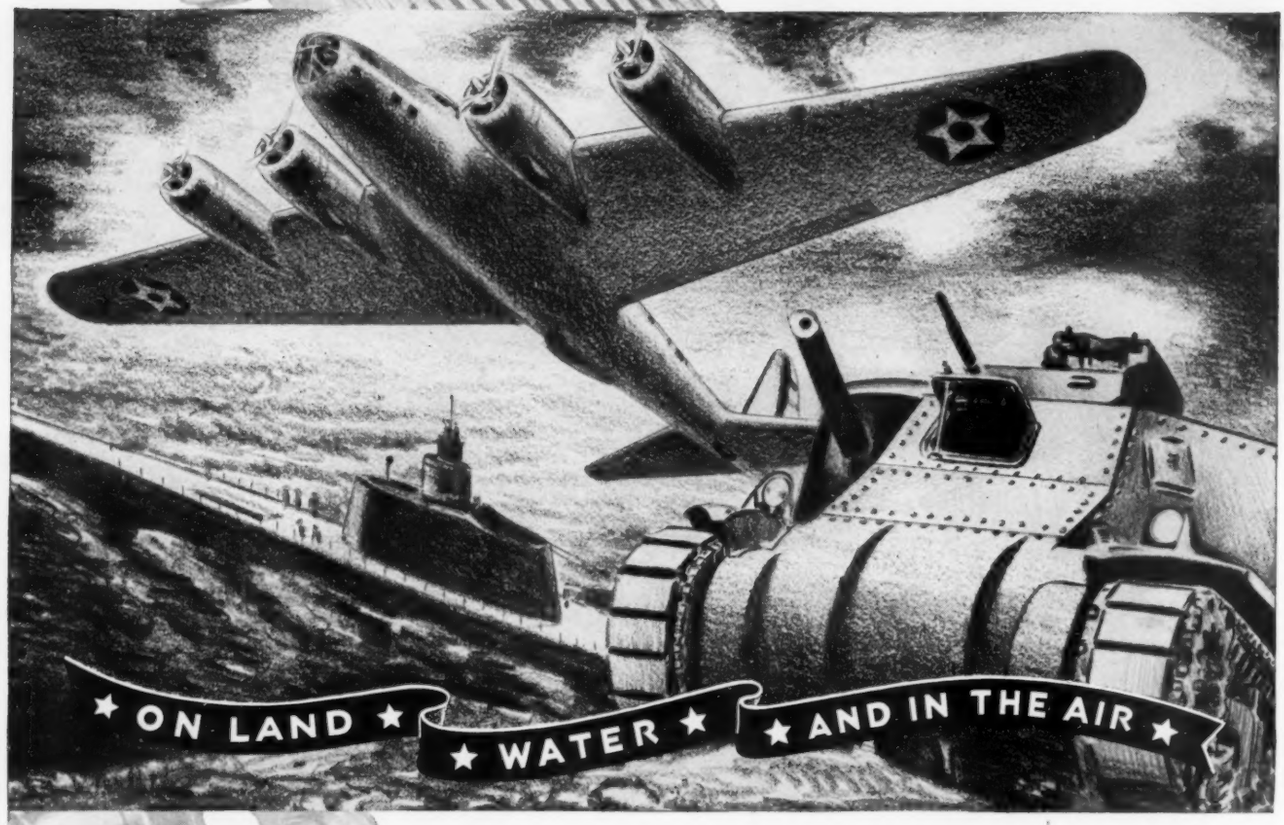

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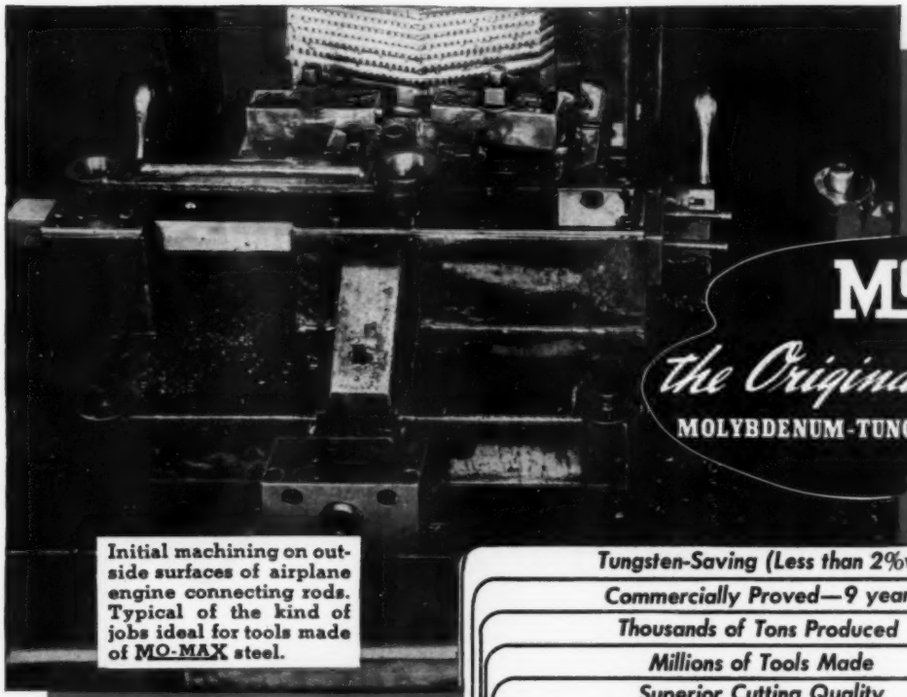

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This Simple Test Shows Why the CONCAVE SIDE Cuts Belt Costs!

What Happens When a V-Belt Bends

FIG. 1

FIG. 2

If you care about belt costs, pick up any V-belt you have handy and make this simple test:—

Bend the V-belt while you grip its sides and you will feel how the belt changes shape. The top, under tension, narrows. The bottom widens. The sides of the belt bulge out. Clearly, if its sides were straight to begin with, the bent belt is forced into a shape that does not fit the sheave groove—as shown in figure 1, on the left.

Now, bend a V-belt built with the patented Concave side. You get the same shape change, but now the new shape exactly fits the sheave groove—as shown in figure 2. There is no side-bulge. Results? (1) Uniform side-wall wear—longer life! (2) The belt gets a full side-width grip on the pulley—carries heavier loads without slippage. This cuts belt costs and saves power.

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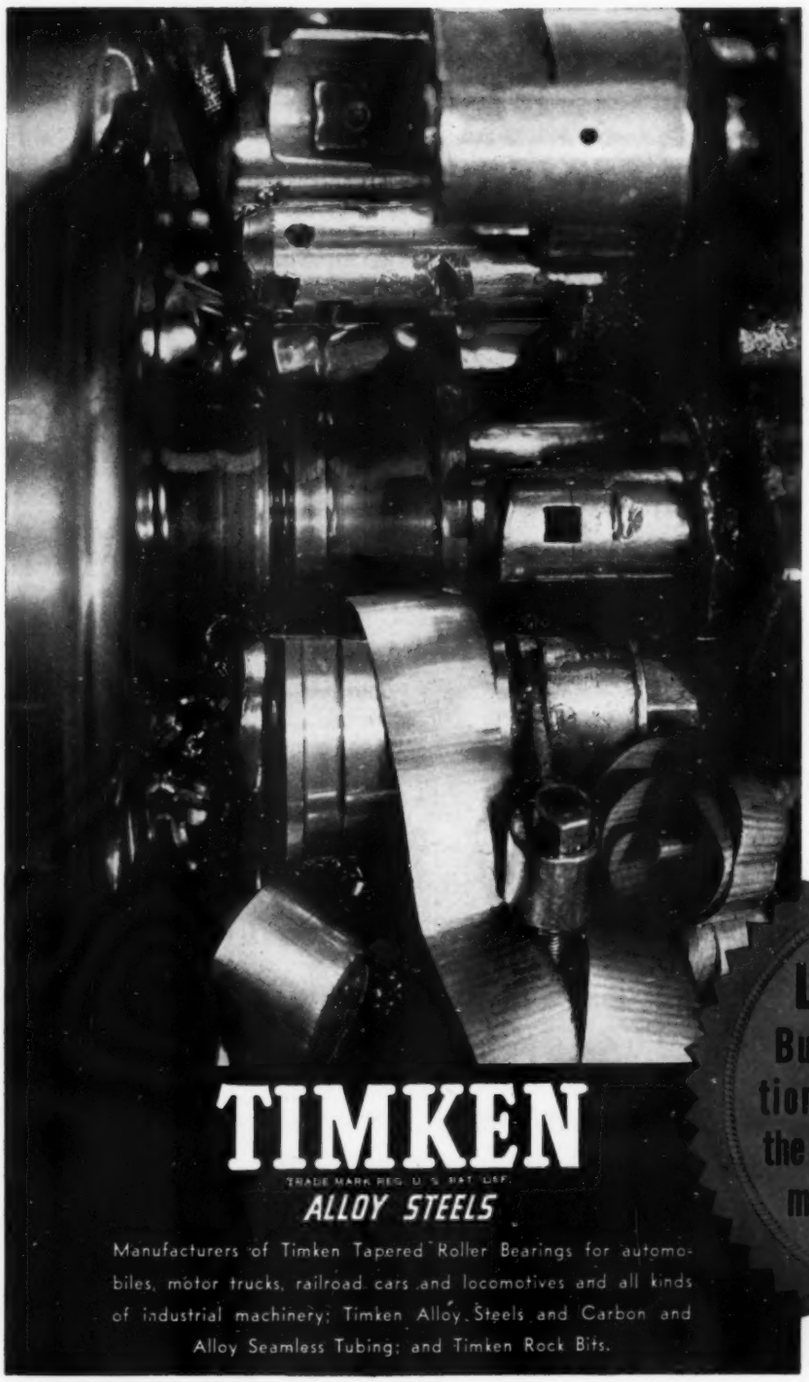
A tip to Machinists

Protect the cutting edges



Protect the cutting edges on your machine tools by using tubing in place of bar stock in the fabrication of cylindrical parts.

The tools are more accessible to the coolant and the cooling action of the air. Lowered temperatures save tool edges, reduce down time and allow longer life.

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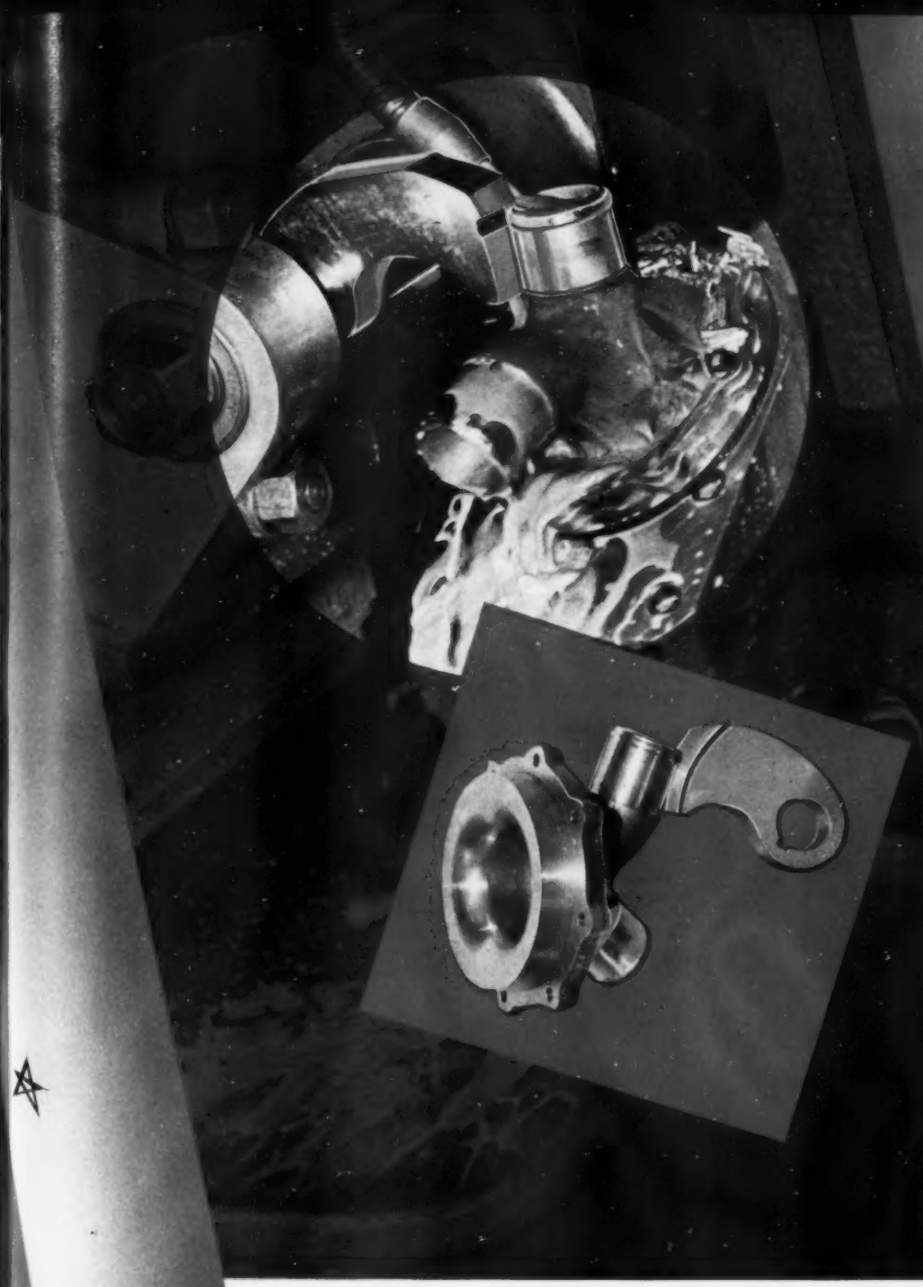

SIMPLIFYING A DIFFICULT TURNING OPERATION

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BUILDERS OF THE CLEVELAND HOBBING MACHINE

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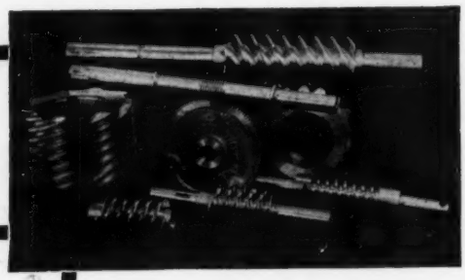

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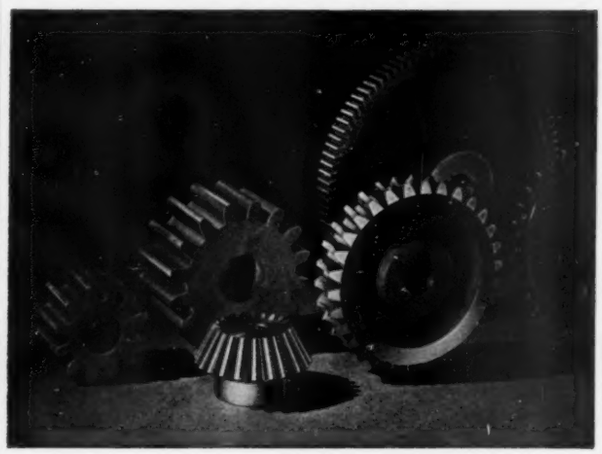

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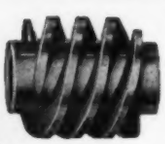

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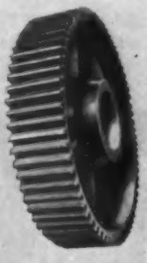

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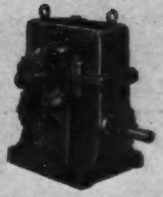

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Yes, why not, when by outlining your requirements and telling us exactly what you need you'll receive sound advice based on our many years experience as gear specialists.

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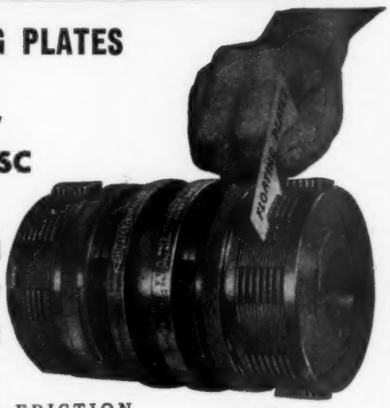
THE NEW "MAXITORQ" MULTIPLE DISC DESIGN.

...for better clutch performance under ANY CONDITIONS



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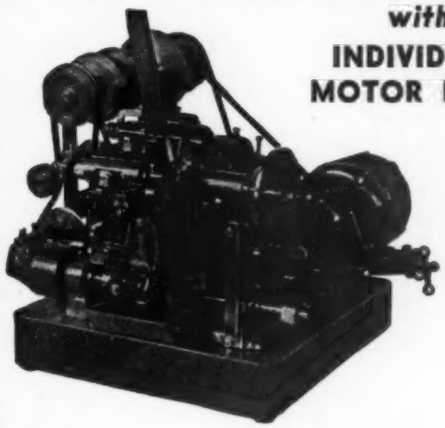

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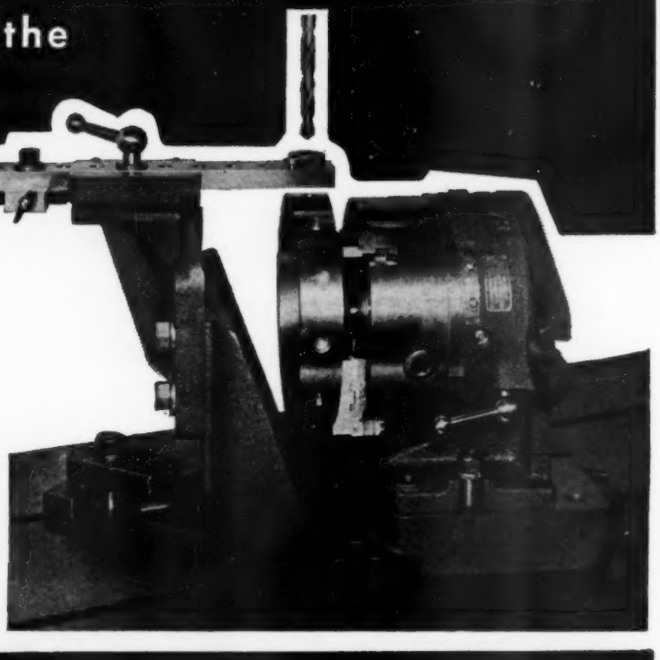

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Get more work out of your Super-Spacer by equipping it with the new Hartford Radial Drilling Attachment NOW! Write today for prices.

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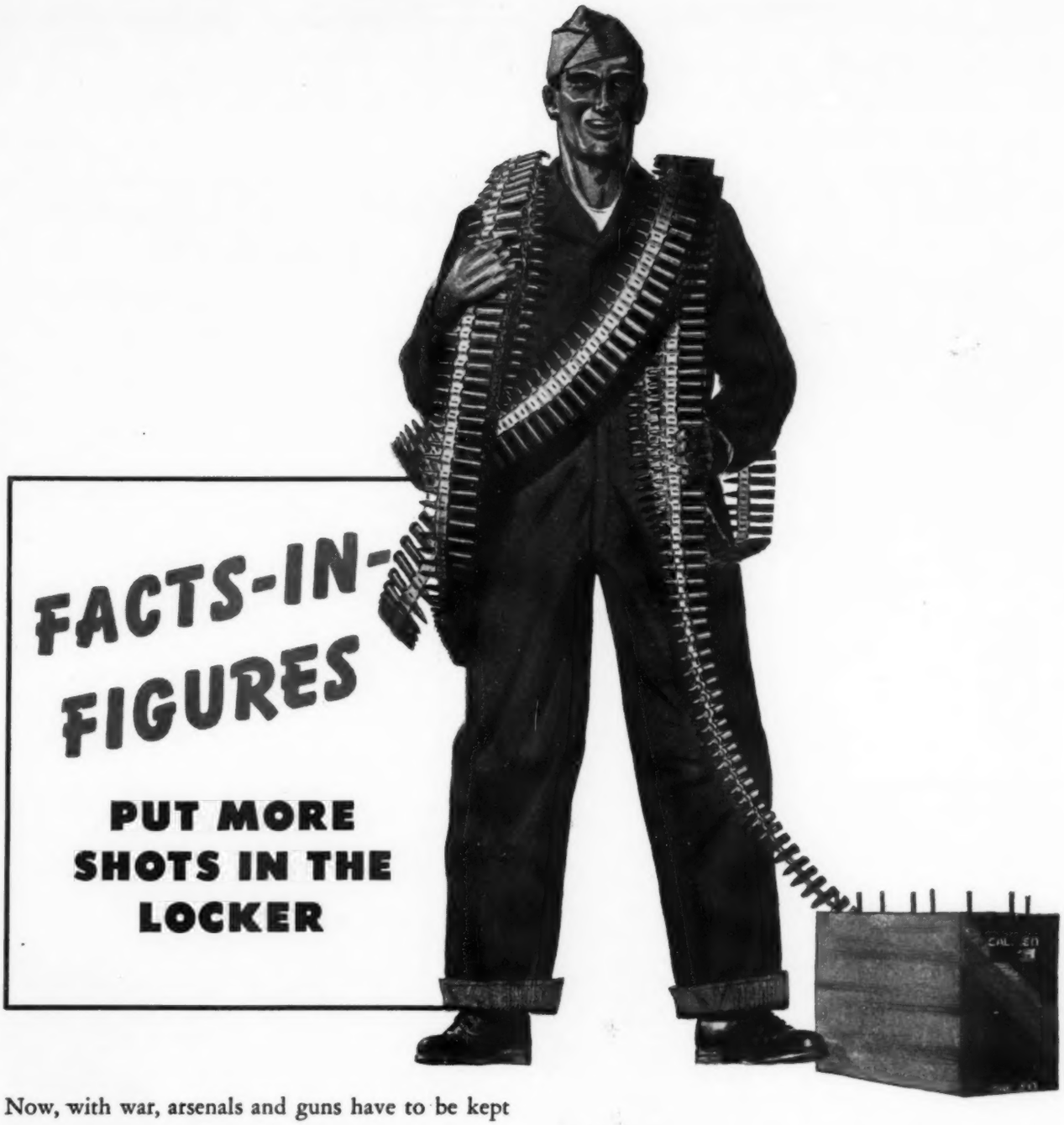

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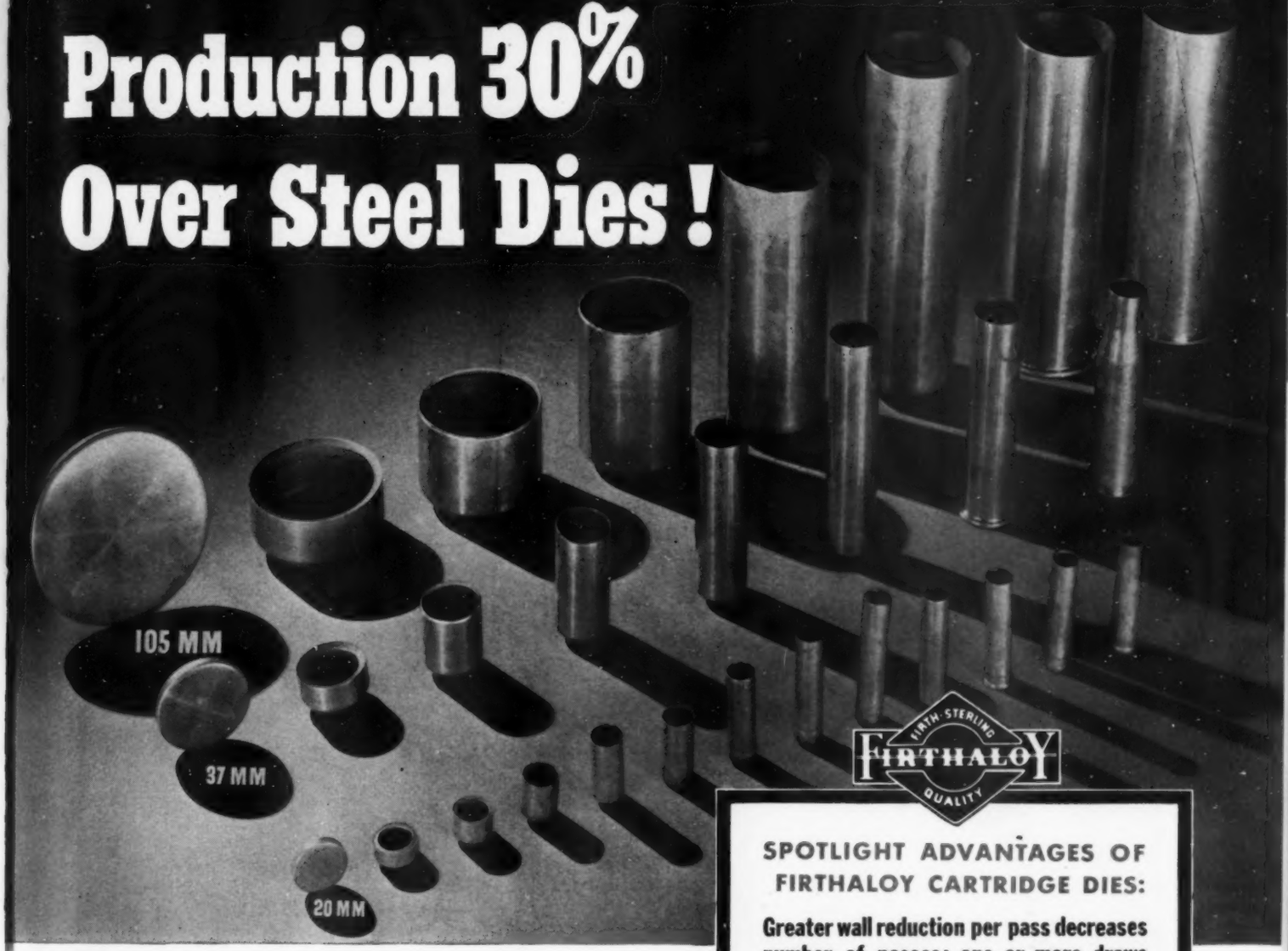

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FIRTHALOY solid or sectional Carbide Dies *definitely increase shell case production* 30% *to* 35%! For this vital manufacturing need FIRTHALOY Cupping and Drawing Dies have proved their productive superiority on cases from 20 mm. to 105 mm. diameter. The advantages of FIRTHALOY dies apply equally to small arms cartridge cases . . . for drawing, loading, pointing, tapering, heading and other requirements.

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**FIRTHALOY is a Sintered Tungsten Carbide.*

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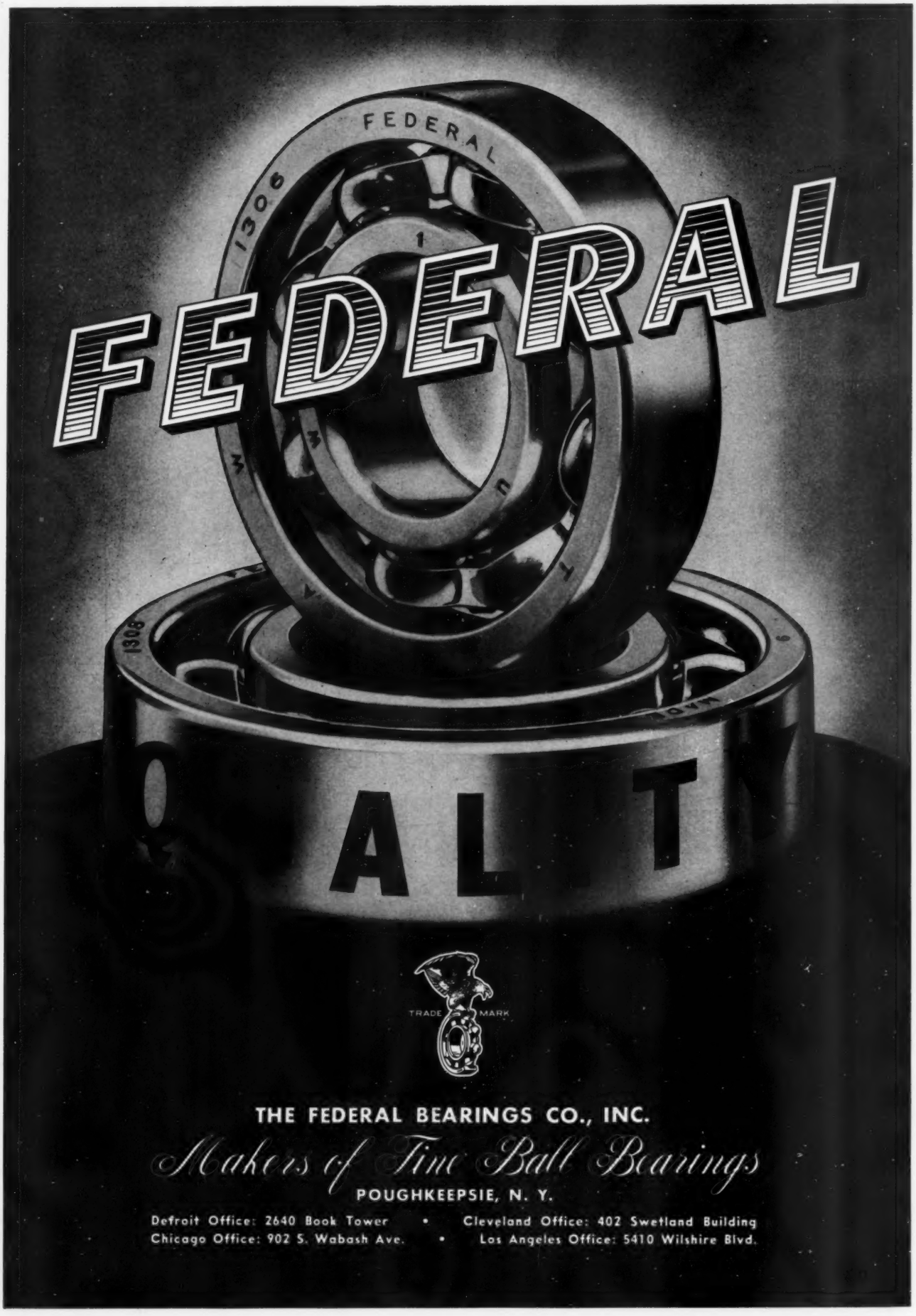
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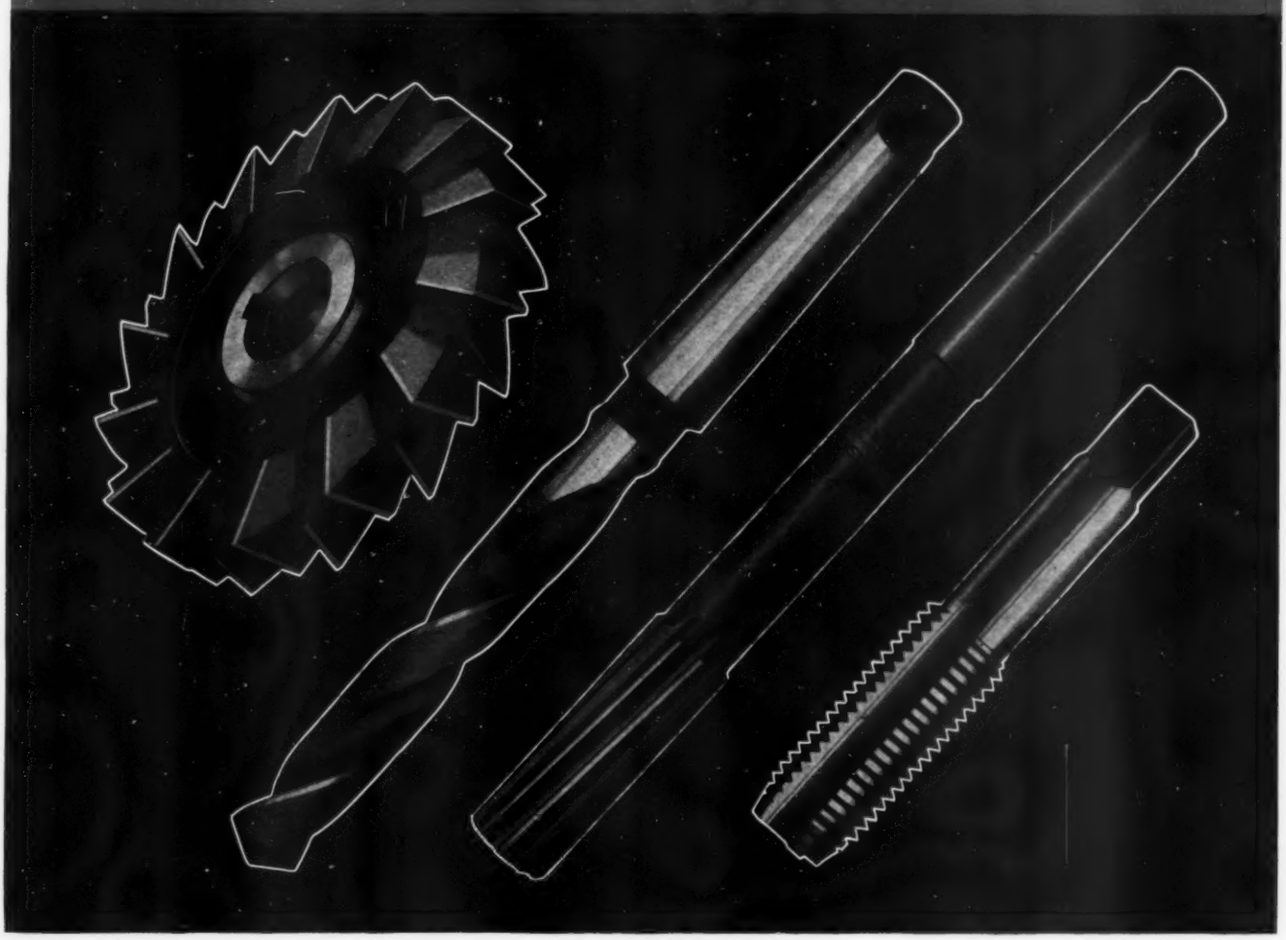
Hour after hour, shift after shift, 24 hours a day — quality tools prove their worth at the workheads by keeping vital defense production on the move.



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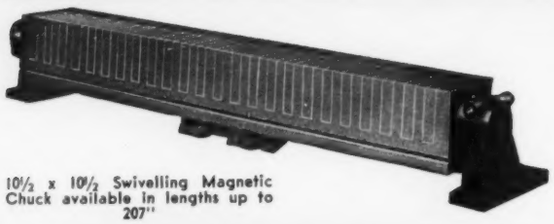

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AUTOMATIC CHUCKING EQUIPMENT

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AND THAT goes for straight and involute splines, and racks. It's easy to train inexperienced help to operate GEARGRIND machines at production speeds, within a surprisingly short time, and turn out satisfactory work.

It is safe to use this type of operator on GEARGRIND machines because every possible safety device has been incorporated in the design for the protection of both the operator and the work.

Best of all, Formed Wheel Grinding produces external and internal gears, external and internal involute splines, straight splines, serrations and racks that are superior in accuracy and high finish—and produces them at the speed necessary to meet rapidly increasing production schedules.

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Internal Gear Grinder

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For MORE THREADING

per day, per man, per machine

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(1) It takes less time to change H&G Chasers. It is only a TWO-minute job to take out and put in a set of inserts.

(2) The cost per set of Insert Chasers is much less; the capital tied up in chaser stocks just a fraction.

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If you have a threading problem, we will be glad to work with you to solve it.

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Price $1.00 Each In Any Size

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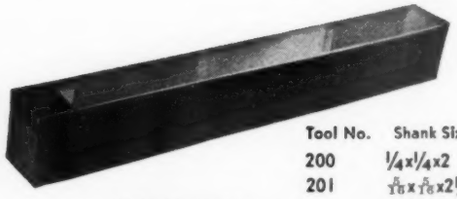
Tools are tipped with Tungsten Carbide, and are suitable for machining cast-iron, brass, bronze, aluminum, non-ferrous materials such as hard rubber, bakelite, fibre, and tough alloy steels up to 500 Brinell hardness

Left Hand-Reverse Image. Right Hand Shown

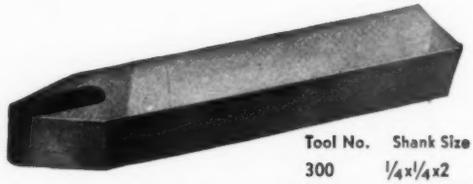
SERIES 100

Tool No. RH	LH	Shank Size
R-100	L-100	1/4x1/4x2
R-101	L-102	5/16x5/16x2 1/4
R-103	L-104	3/8x3/8x2 1/2
R-105	L-106	7/16x7/16x3
R-107	L-108	1/2x1/2x3 1/2



SERIES 200

Tool No.	Shank Size
200	1/4x1/4x2
201	5/16x5/16x2 1/4
202	3/8x3/8x2 1/2
203	7/16x7/16x3
204	1/2x1/2x3 1/2



SERIES 300

Tool No.	Shank Size
300	1/4x1/4x2
301	5/16x5/16x2 1/2
302	3/8x3/8x2 1/2
303	1/2x1/2x3 1/2

Standard Tungsten Carbide Tipped Tool Bits

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Sizes not listed as well as special TIPPED TOOLS will be quoted upon request. When ordering, state tool number and quantity desired.

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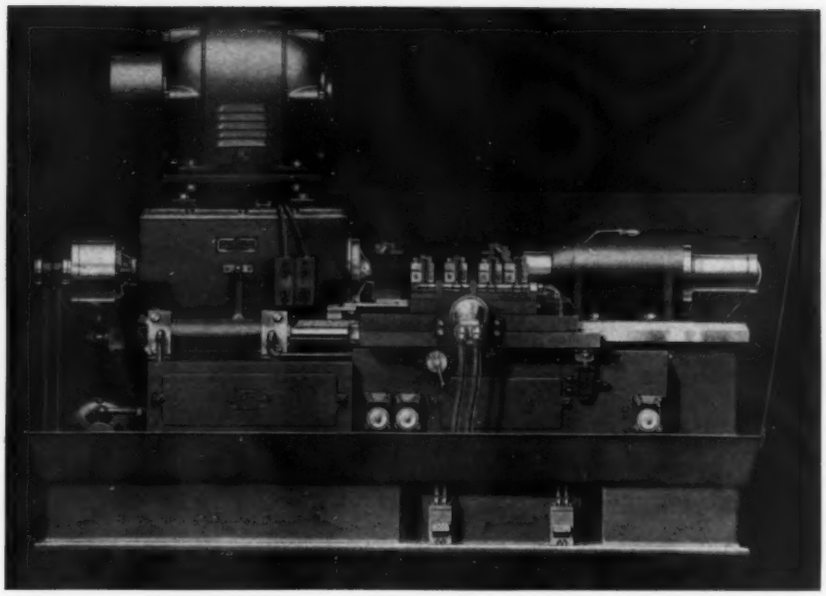


SHELL BODIES from 75 M/M to 155 M/M
Quickly Rough and Finish Machined

on the SPARKS *Semi-Automatic* HYDRA-FEED LATHE

SIMPLE AND AUTOMATIC IN OPERATION

This recently developed machine—designed specifically for high speed, accurate shell production—can be depended on for the fast turning of shell bodies with Tungsten-Carbide tools. It is amply powered, sturdily built and easily handled.

The Sparks Hydra-Feed Lathe is equipped for automatic operation by the use of power feeds and hydraulically operated duplex brake and clutch for starting and stopping spindle. All movements of the carriage are provided with automatic stops; cross slide is equipped with hydraulic and automatic stops; spindle chuck or expanding arbor are hydraulically operated.

Other features include: roller bearing revolving tail stock spindle; motor driven coolant pump with pan and tank; complete electrical control equipment with proper size motors for each size of shell.

CONDENSED Specifications

Swing over ways—31"

Swing over carriage—11½"

Extreme distance between chuck and tail center—38"

Diameter of quill 7"—Roller bearing live center

Length of bed 7' 6"

Height—floor to center of spindle—38"

4-speed geared headstock

Carriage feeds (per revolution of spindle)—from .004" to .130"

Cross feeds for facing or contouring attachments per revolution of spindle—.004" to .211".

Sequence of Machining Operations

With a battery of SPARKS Lathes set up for machining 75 M/M to 155 M/M shell bodies, the following operations are handled:

1—Rough turn shell body, face base and cut off to length.
2—Finish turn outside body, finish turn nose contour to Bourrelet.
3—Bore and chamfer, ream and chamfer and recess.
4—Finish face base and turn band seat.
5—Machine band.

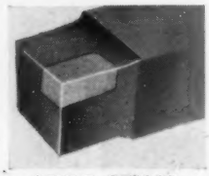
Investigate Today by Sending for Complete, Detailed Information

SPARKS HYDRA-FEED LATHE

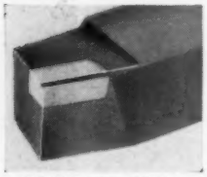
SPARKS MACHINE TOOL CORPORATION
NORWALK . . . . CONN.

Get More Done WITH

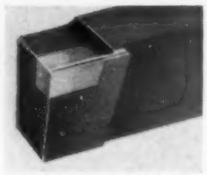
KENNAMETAL STEEL-CUTTING CARBIDE TOOLS



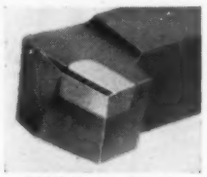
STYLE 3 TOOL



STYLE 11 TOOL



STYLE 1 TOOL



STYLE 21 TOOL

MORE WORK PER MACHINE
KENNAMETAL turns, bores, and faces steel of all hardnesses up to 550 Brinell at *two to six times faster speeds than high speed steel*, while often combining roughing and finishing in one cut. In many cases, KENNAMETAL permits your lathe, boring mill, or automatic to turn out twice as much work per machine in the same time as when high speed steel tools are used.

MORE WORK PER TOOL
KENNAMETAL is harder than any tool steel . . . removes three to ten times more metal per tool grind than high speed steel. Furthermore, KENNAMETAL mobilizes tungsten, cobalt, and other valuable tool materials at the point of the tool . . . cutting 50 to 60 times more metal per pound of alloy consumed.

MORE WORK PER KILOWATT
Although machine tools where KENNAMETAL is used should be equipped with large motors to drive them at the high speeds required, the high cutting efficiency of KENNAMETAL actually results in less power consumption per pound of metal removed.

COMPARE THESE DELIVERY DATES
Standard and Modified Standard KENNAMETAL tools are shipped within 10 days of receipt of order; tool blanks within 3 to 4 days. Write for Catalog No. 42 which contains specifications and prices of standard tools and blanks.

KENNAMETAL
The Accepted
STEEL CUTTING CARBIDE

McKENNA METALS Co.
103 LLOYD AVE., LATROBE, PA.
Foreign Sales: U. S. STEEL EXPORT CO., 30 Church St., New York
Exclusive in Canada and Great Britain

"LARGEST MANUFACTURER OF STEEL-CUTTING CARBIDE TOOLS"

CANADIAN AGENT: KENNAMETAL TOOLS & MFG. CO., LTD., 24 DUNBAR AVE., HAMILTON, ONTARIO

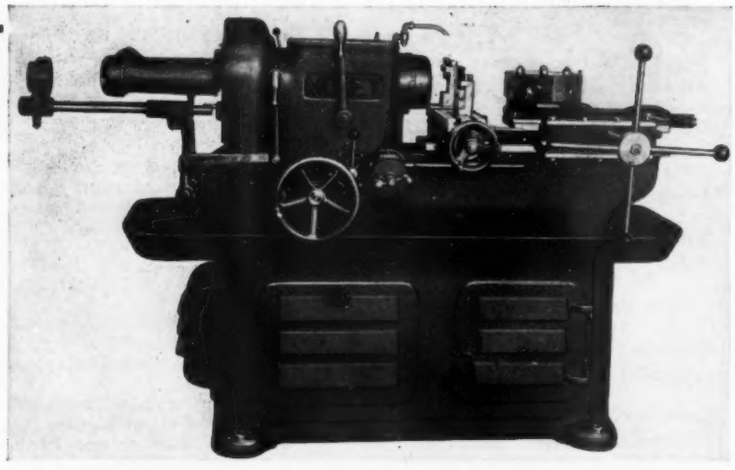
MOREY NO. 2G & NO. 3 TURRET LATHES

Motor Drive
Infinite Spindle Speeds

Any spindle speed you want—a direct reading dial shows when you've got it.
Permits the use of carbide tools for fast cutting.
Turret clamps and unclamps automatically.
Equally effective on second operation and chucking work.

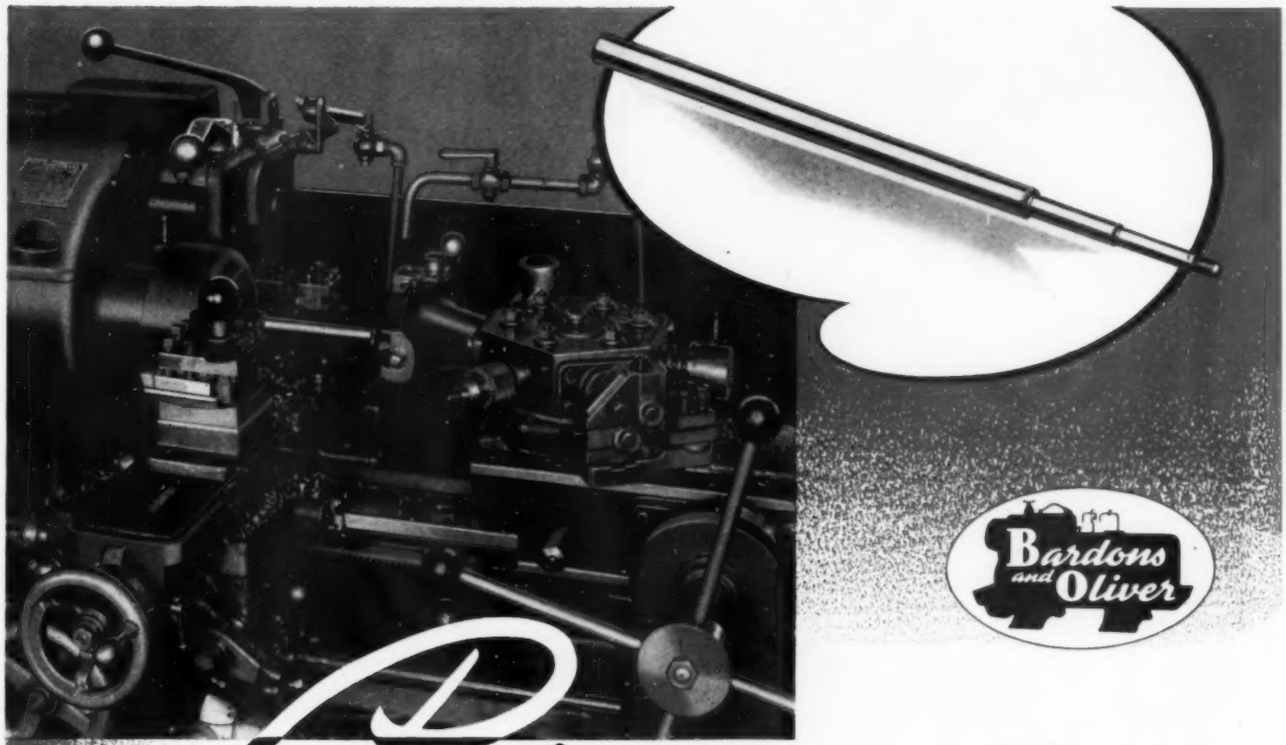
No. 2G
SPEEDS from 90 to 180 R.P.M. or 180 to 3600 R.P.M.
CAPACITY 1" x 6½" turning length.
Ask for Bulletin #629

No. 3
SPEEDS from 60 to 2100 R.P.M. or 100 to 3600 R.P.M.
CAPACITY 1½" x 9" turning length.
Made in Plain and Universal Types
Ask for Bulletin #727



TIMKEN TAPERED ROLLER BEARINGS FOR THE MAIN SPINDLE
ALL OTHERS ANTI-FRICTION

MOREY MACHINERY CO., Inc.
410 BROOME ST. • • • • NEW YORK, N.Y.



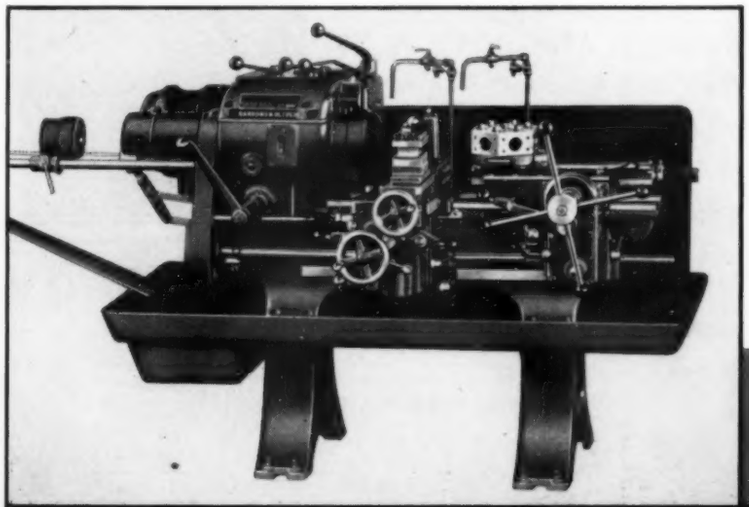
Production...with ease

THE BARDONS & OLIVER UNIVERSAL TURRET LATHE No. 3

is outstanding in the production of small bar and chucking work.

Where seconds count, the value of the light, close coupled turret and cross slide shows up through greater production. Operators appreciate the ease of handling.

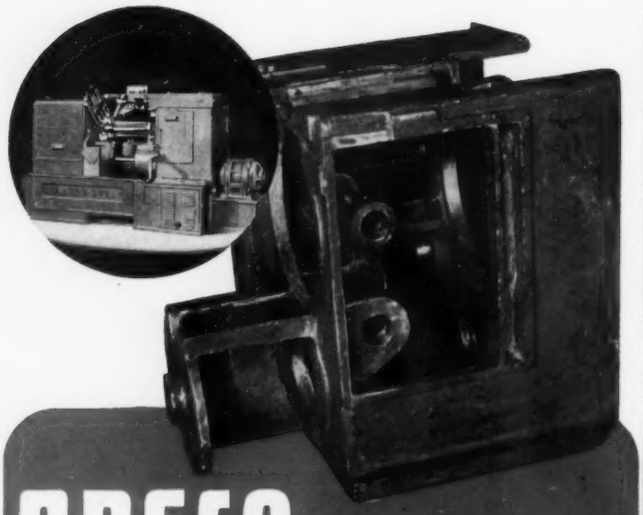
The powerful drive is coupled with abundance of rigidity for multiple cutting and fast removing of metal. The hexagon turret tools can readily be brought into simultaneous action with the cross slide tools, even on small and comparatively short work.



As the smallest, most compact, and beyond compare, the fastest Universal Turret Lathe available today, it covers a field of work pre-eminently its own.

Learn more about this high production Turret Lathe. Write for catalog covering complete details.

BARDONS & OLIVER, Inc.
1133 W. 9th STREET • CLEVELAND, OHIO



ABSCO MEEHANITE DID THIS JOB

1275 lbs. ABSCO Meehanite power case casting for New Britain-Gridley automatic screw machine.

What can it do for You?

Selective processing **of ABSCO Meehanite provided the needed combination of strength with machinability and high damping capacity required by New Britain-Gridley for the power case casting of this automatic screw machine.**

Have you any problems of procurement or exacting specifications? If so, ***selective processing*** **of Meehanite under our complete technical control can provide you with a grade of metal needed for your particular requirements.**

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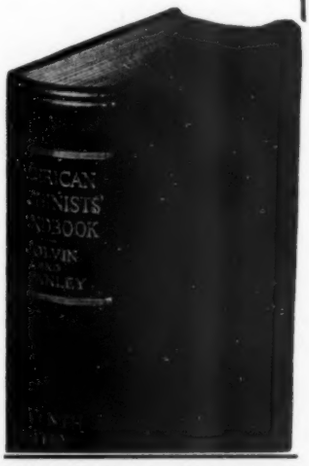

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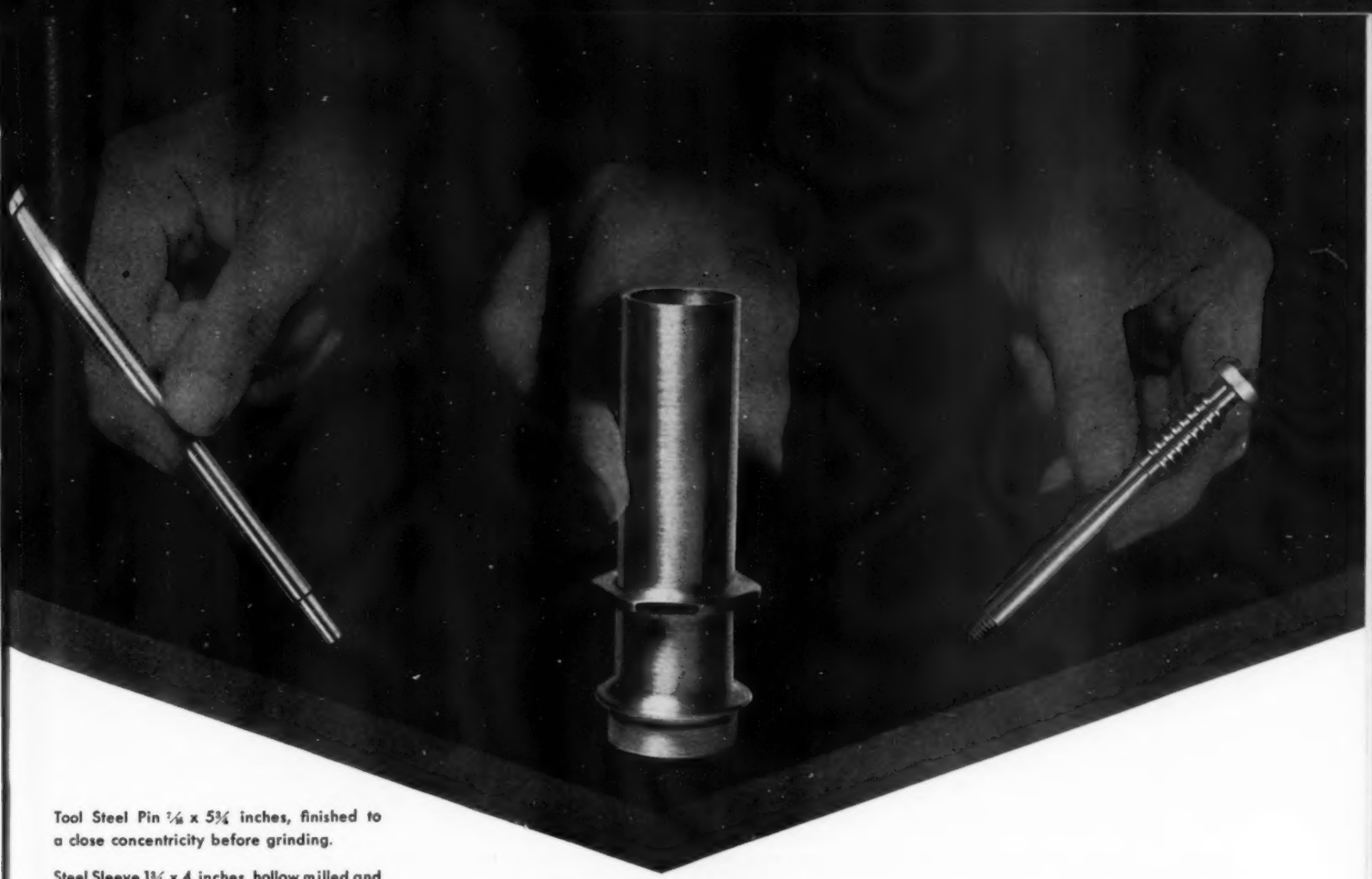


Tool Steel Pin ⅛ x 5¾ inches, finished to a close concentricity before grinding.

Steel Sleeve 1¾ x 4 inches, hollow milled and reamed at one pass, ready for grinding.

Bronze Valve Stem ⅜ x 4 inches, small body diameter finish hollow milled. Thread also cut with Namco circular chaser die.

HOW

TO SAVE TIME AND GET BETTER FINISH ON END TURNED JOBS

The long diameters on these three multiple spindle screw machine jobs were rough turned, then HOLLOW MILL finished with Namco Multiple Circular Cutter Self Opening Heads.

These heads take four chips at one pass — more than 3 times faster than single pointed turning tools.

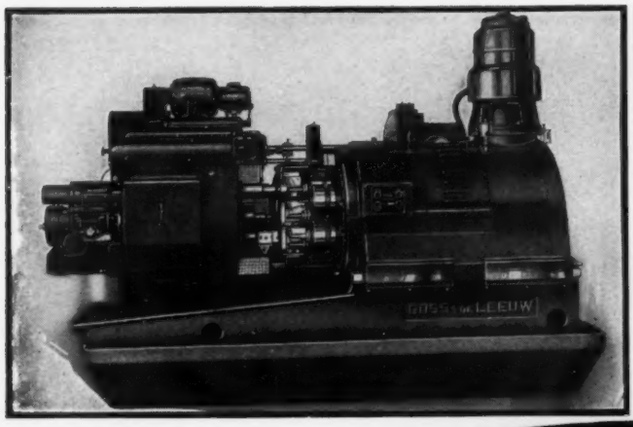
In addition to opening for a quick get-away at end of the cut, these single pass finishing tools avoid steps on long cuts and eliminate tool marks in backing off. This gives a smoother machine finish and also cuts time and costs on parts that are finish ground.

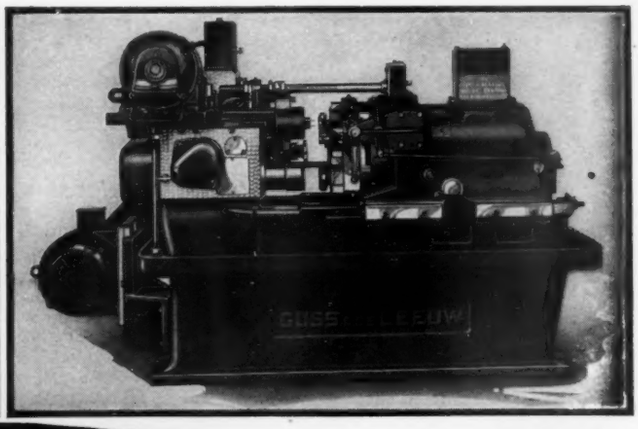
An extra set of circular cutters, ground to micrometer gage in the tool room, requires only one adjustment in the head, reduces down time and avoids scrap loss. Ask for circular cutter hollow mill information on your work.

NATIONAL ACME

170 EAST 131ST STREET • CLEVELAND, O.

ACME-GRIDLEY 4-6 AND 8 SPINDLE BAR AND CHUCKING AUTOMATICS • SINGLE SPINDLE AUTOMATICS • AUTOMATIC THREADING DIES AND TAPS • SCREW MACHINE PRODUCTS • THE CHRONOLOG • LIMIT SWITCHES • POSITIVE CENTRIFUGE • CONTRACT MANUFACTURING





WORK ROTATING TYPE

5 Spindles
6 Spindles
8 Spindles

GOSS & DE LEEUW *Multiple Spindle* CHUCKING MACHINES

TOOL ROTATING TYPE

4 Spindles
5 Chucking Positions

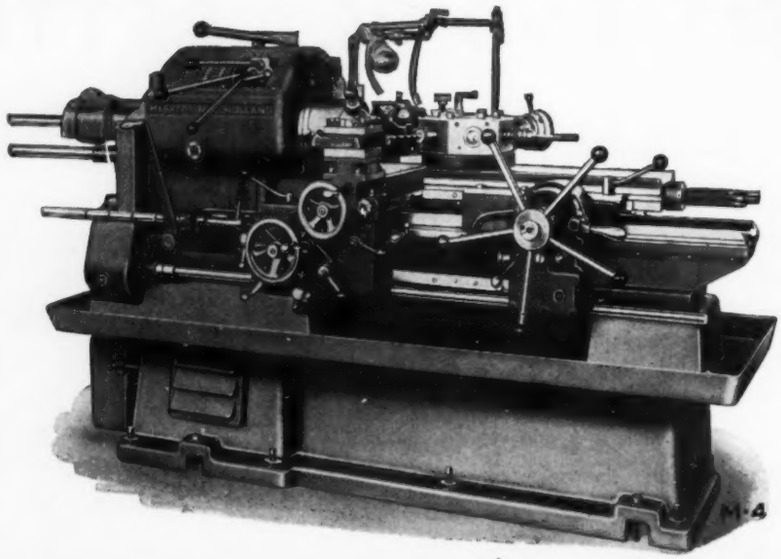
On these machines, two threading operations can be handled simultaneously, each thread controlled by its own lead screw.

Among the many other modern features offered in both types are: pre-loaded anti-friction spindle bearings, hardened ways, oversize spindles and gears of chrome-nickel steel, heat-treated.

Complete details will be found in descriptive catalog available on request.

GOSS & DE LEEUW MACHINE CO., NEW BRITAIN, CONN.

MODEL 4 2" BAR CAPACITY MERRITT-MILLHOLLAND TURRET LATHE



★

A Modern Machine Tool Designed for Low Cost Production

★

Favorable Deliveries

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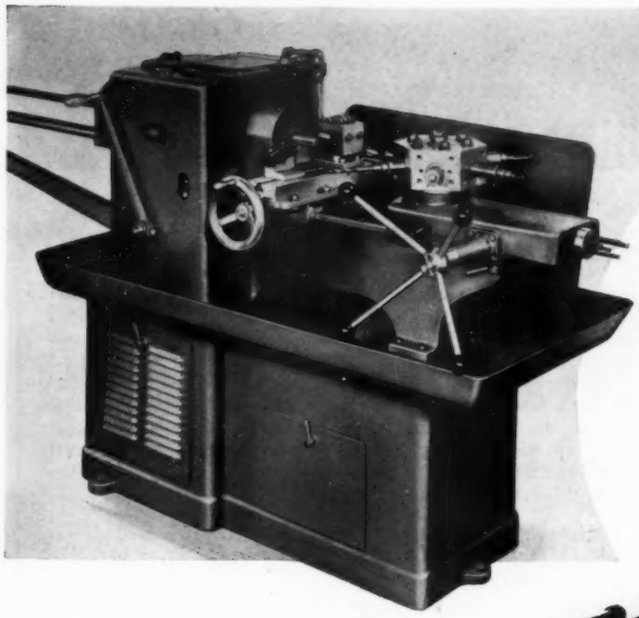
Also 2½" Bar Capacity Available

MERRITT ENGINEERING & SALES CO., INC.
126 SOUTH MERRITT ST., LOCKPORT, NEW YORK



For Delivery before April

Hurry!

Place orders now for the OSTER NO. 601 SIMPLIFIED TURRET LATHE

No. 601 is SIMPLIFIED. Ideal for rapid training of new men. *Highly skilled operators not required.*

Our enlarged plant at Cleveland, Ohio and our modern factory, at Erie, Pa., are teamed up to make deliveries of the No. 601 Turret Lathe *in 8 to 10 weeks from receipt of orders.*

Batteries of No. 601s are in action in numerous defense plants. Recently, 29 machines were ordered by one shell manufacturer for first and second operation work on 40mm shells.

No. 601 is a precision-built, bar and chucking machine; motor driven; equipped with either six position turret or plain saddle, as required. Optional types of drive: *direct* (for spindle speeds up to 3000 R.P.M.) or *worm drive* (for slower spindle speeds. Unusually heavy forming cuts are obtainable with the worm drive).

Automatic chuck capacity, round bar, is 1-1/2". Swing over bed is 14". Swing over cross slide is 6-1/2".

Complete details in illustrated Catalog No. 27-A. Send for copy NOW. *See convenient request form below.*

OSTER

Hurry

THE OSTER MFG. CO. • 2049 East 61st St., Cleveland, Ohio

Rush, by return mail ..... copies of Catalog No. 27-A which contains full description and detailed illustrations of No. 601 Turret Lathe.

NAME .....

ADDRESS .....

CITY ..... STATE .....

A Quick, Smooth, Uniform coating — assured by

BARRETT GALVANIZING AND HOT TINNING CENTRIFUGALS

BARRETT CENTRIFUGAL GALVANIZER is driven with high torque head and has an equalized disc brake for quick stop.

With these new Barrett machines for expelling excess metal from small parts after dipping in molten metal, faster and better work is assured which will pass the most rigid inspection for quality.

The method of handling work is simple and easy. Work to be processed is placed in a basket and submerged in a kettle of hot molten metal. When thoroughly heated, the basket with the work is transferred into the Barrett Centrifugal where the basket is revolved and the excess metal thrown from the work. A quick pick up and stop (from 2 to 3 seconds each) assures fast work. Then too, quick pick up snaps the excess metal from the work before centrifugal action comes into play. With Barrett Equipment excess molten metal can be quickly thrown off before the metal cools, thereby assuring smooth, even thickness of coating.

Barrett Centrifugals for Galvanizing with and without heated drums are available in capacities from 40 to 240 loads per hour handling from 5 to 100 lb. loads. For tinning, Barrett offers the #0 Centrifugal Machine, operated similarly to the Galvanizers. On threaded work, tinning is so exactly done that rethreading is unnecessary.

Barrett Galvanizers, combining convenience of operation with the utmost in speed and safety are developed to meet the requirements of actual use by men thoroughly familiar with this class of work. They are self-contained and occupy the minimum of floor space.

Send at once for full details of Barrett Centrifugal Galvanizer

THE LEON J. BARRETT CO., WORCESTER, MASS.

Designers and Builders of Centrifugal Machinery

SELECT THE RIGHT WHEEL

AND SAVINGS WILL FOLLOW

Vitrified makes it possible to standardize on grinding wheels by offering a wide range of standard types which cover practically all wheels used on standard makes of grinding machines.

Selection of the right wheel for the work to be handled is simplified in the Vitrified catalog—a 65-page booklet which gives specific data, dimensions, etc., covering the entire Vitrified line.

Send for this catalog. Choose a grinding operation in your shop on which you would like to cut costs. Select the Vitrified wheel which meets your specifications, try it out, and compare results with the method formerly used—and you, too, will join the long list of progressive manufacturers which have standardized on Vitrified.

Write for the catalog today

VITRIFIED

VITRIFIED WHEEL COMPANY

WESTFIELD MASS.

SAVE MONEY QUICKLY*

with these Low-Cost Abrasive Belt

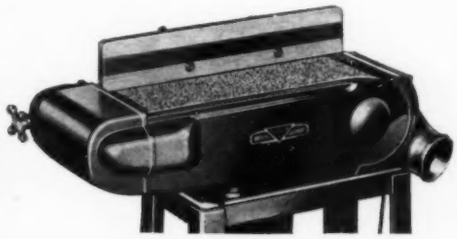
Finishing Machines

***One manufacturer stepped up production 600%!**

There's a place in your shop to reduce costs and save money with this Delta 6" belt-type Abrasive Finishing Machine. It's heavy and husky enough to handle any of the dozens of sanding and polishing operations around the shop—and yet is portable enough to be moved just where it is needed. Many shops are using this machine for polishing and sizing metal parts (*in one plant making precision instruments, production was increased 600% by the use of this Delta machine).

Die-casters, also, use it as a finishing and polishing machine, with a great saving in power cost over larger machines. For finishing, finning and surfacing plastic parts, it has found wide acceptance. Many shops have used combinations of this unit to make up special machines at a great saving. It is adaptable for practically any small industrial finishing operation.

HAS MANY UNUSUAL FEATURES



Completely Enclosed—Thoroughly Guarded

Only the portion of the belt that is being used is open, the ends and bottom of the belt, as well as the drums, being completely covered. The guard covering the end drum may be removed in a moment, for use in finishing long materials, or for curved work. This complete enclosure also increases the efficiency of the dust removal system.

Completely Ball-Bearing Equipped

Double-seal bearings, lubricated at the factory for life. No rubber covering required on drums, thus eliminating one source of replacement expense. Adjustable deflector on drum hood catches practically all dust. Hood is provided with suction spout. This machine may be set horizontally, as shown above and equipped with a wood fence for edge or face sanding, if required. Or it may be used vertically, in connection with the 7½" x 14¾" tilting table as shown to the right. Cloth-backed belts, 6" wide by 48⅝" long. Aluminum-oxide belts for metal finishing. Adjustable fence for edge sanding and adjustable back stop for flat sanding are available for use in horizontal position.

SEND FOR FULL DETAILS

For complete specifications and low prices on Delta Abrasive Belt Finishing Machine send coupon below for latest Delta Catalog.

DELTA
MILWAUKEE

THE DELTA MFG. CO.
607-A E. Vienna Ave., Milwaukee, Wis.

Gentlemen: Please send me latest Delta Catalog giving full details on your Abrasive Belt Finishing Machine and other low-cost high quality Delta machines.

Name .....

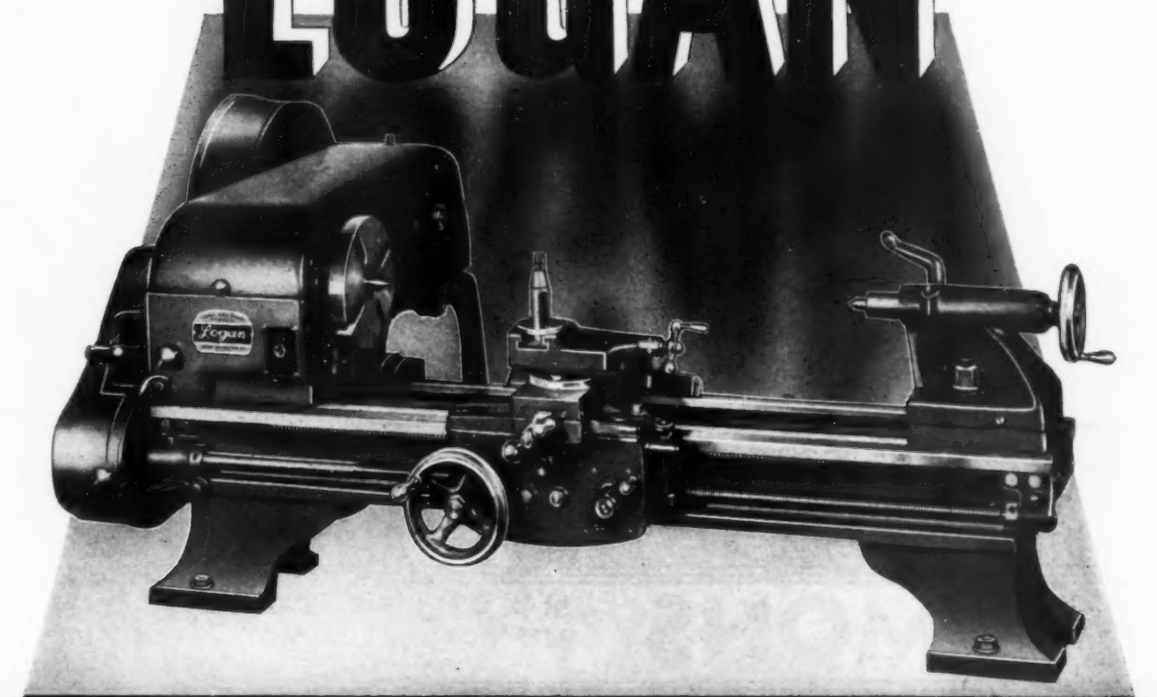
Address .....

Night and DAY for 1942

WE PLEDGE the entire resources, facilities and man power of our organization, twenty-four hours of every day to the production of more grinding wheels of the same high quality, in our endeavor to cooperate to the very fullest with all of America's defense plans. This pledge we make sincerely and most wholeheartedly.

BAY STATE
ABRASIVE PRODUCTS CO.
WESTBORO, MASSACHUSETTS

LOGAN



No. 210 Logan Bench Model Back Geared Screw Cutting Lathe
Also furnished in Floor Model, No. 200

Logan

A NAME TO REMEMBER WHEN YOU THINK OF LATHES

Advanced design, sound engineering, expert workmanship and rigid inspections combine to make the Logan Lathe the fine machine that it is . . . The use of ball bearings in the headstock, the patented countershaft assembly with its three-point suspension, rubber mountings and streamlined design are typical of Logan's high standards and forward thinking.

BRIEF SPECIFICATIONS

10" swing; 24" between centers ★ Bed 6 15/16" wide by 43⅛" long ★ Prismatic V and flat ways, hand scraped and honed ★ New Departure precision pre-loaded ball bearing headstock spindle ★ Thread cutting, 4-216 per inch ★ 25/32" hole through spindle, ½" collet capacity ★ 12 spindle speeds, 30 to 1450 revolutions per min.

LOGAN ENGINEERING COMPANY
CHICAGO, ILLINOIS

TURRET NO. 2 LATHES

1000 DIFFERENT SPINDLE SPEEDS INSTANTLY . . . AT THE TURN OF A DIAL

SPINDLE BRAKE AND CLUTCH FOR INSTANT STOPPING AND STARTING

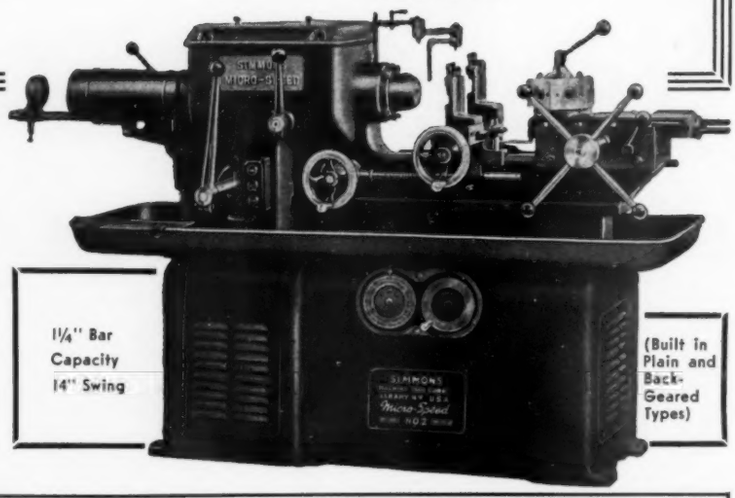
Today's all-out production calls for fast, versatile turret lathes that work with perfect accuracy on any kind of metal. That's why many important defense manufacturers praise the performance of Simmons Turret Lathes*

Simmons No. 2 Turret Lathes (1¼" bar capacity) give you any of 1000 different spindle speeds at the turn of a handwheel adjacent to the Selector Dial on the front of the machine.

Result? The right speed for the job! And that means closer tolerance—faster production.

Write Today for Illustrated Brochure.

*Letters from users of Simmons Turret Lathes, testifying to their superiority will be furnished upon request.



SIMMONS

MACHINE TOOL CORP.
1759 NORTH BROADWAY, ALBANY, N. Y.
NEW YORK OFFICE: 149 BROADWAY

Spring tempered COLLETS

Order From Stock

Scientifically heat treated to a true spring temper, "Rivett Mark" collets resist wear and hold their spring longer than collets of any other make. As standard equipment on all makes of lathes and millers, (see Rivett Bulletin 100B) they may be ordered for immediate delivery from the following stocks —

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BOSTON
Rivett Lathe & Grinder Inc
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LATHE & GRINDER INC.
BRIGHTON, BOSTON, MASS.

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- Short-cuts finishing operations
- Removes heat marks after welding
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The SOFT RUBBER binder CUSHIONS the abrasive

BRIGHTBOY INDUSTRIAL DIVISION
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BRADFORD

GEARED HEAD LATHES...

. . . MEET THE

SPEED AND ACCURACY REQUIREMENTS

OF WAR PRODUCTION!

Intensified production being the order of the day, there's no better choice for metal turning operations than BRADFORD Geared Head Lathes.

First, BRADFORDS provide a sufficiently wide range of spindle speeds to accommodate all normal cutting operations. The Geared Head of BRADFORD Lathes permits twelve selective speeds, forward and reverse, from 16 to 400 r.p.m. . . . a fact that assures maximum cutting efficiency at all times (higher speeds can be furnished if desired). Second, accuracy is particularly stressed . . . there's an automatic stop for feeds . . . a thread indicator is fitted to all units. The many "accuracy attachments" that distinguish BRADFORD units are assurance of fewer rejects, no waste turning and less scrap material.

Here, then, are two of many reasons why BRADFORD Geared Head Lathes are ideally suited for your work . . . they have the speed and accuracy so necessary for today's vital war needs. In sizes of 12", 14" and 16" . . . write for more detailed descriptions . . . also delivery dates, prices, etc.

THE BRADFORD MACHINE TOOL CO.
CINCINNATI, OHIO
MAKERS ALSO OF UNIT TYPE DRILLING & TAPPING EQUIPMENT

PRECISION TOOLS SINCE 1840

WILLARD Spring TOOL HOLDERS

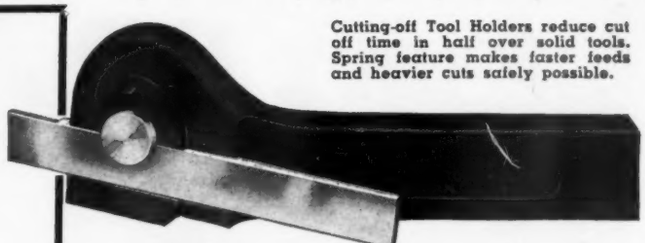
FINER QUALITY WORK AND FASTER CUTS—ASSURED WITHOUT CHATTER OR DANGER OF TOOL BREAKAGE . . . . . .

Willard Tool Holders have been specially developed to save time and insure precision on high production repetitive work such as that demanded in shops busily engaged in AUTOMOTIVE, AIR CRAFT and DEFENSE MANUFACTURING.

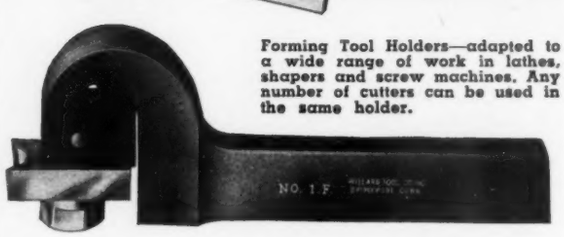
They are available for a wide number of operations and hold tools securely against chatter. Cutter breakage is eliminated and the possibility of damaged work reduced to a minimum.

PROMPT DELIVERIES

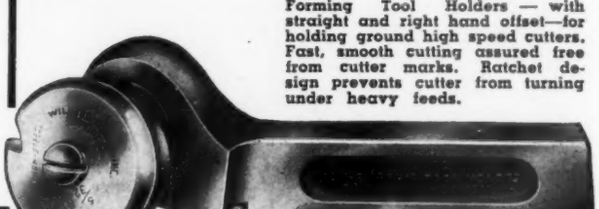
Write today for descriptive folder which gives details on Willard Tool Holders for Forming, Threading and Forming Tools, Cutting Off Tools and Threading Tools.



Cutting-off Tool Holders reduce cut off time in half over solid tools. Spring feature makes faster feeds and heavier cuts safely possible.



Forming Tool Holders—adapted to a wide range of work in lathes, shapers and screw machines. Any number of cutters can be used in the same holder.



Forming Tool Holders — with straight and right hand offset—for holding ground high speed cutters. Fast, smooth cutting assured free from cutter marks. Ratchet design prevents cutter from turning under heavy feeds.

Product of **AUTO-ORDNANCE CORPORATION**

Manufacturers of THE THOMPSON SUBMACHINE GUN

TRADE-MARK Thompson REG. U.S. PAT. OFF.

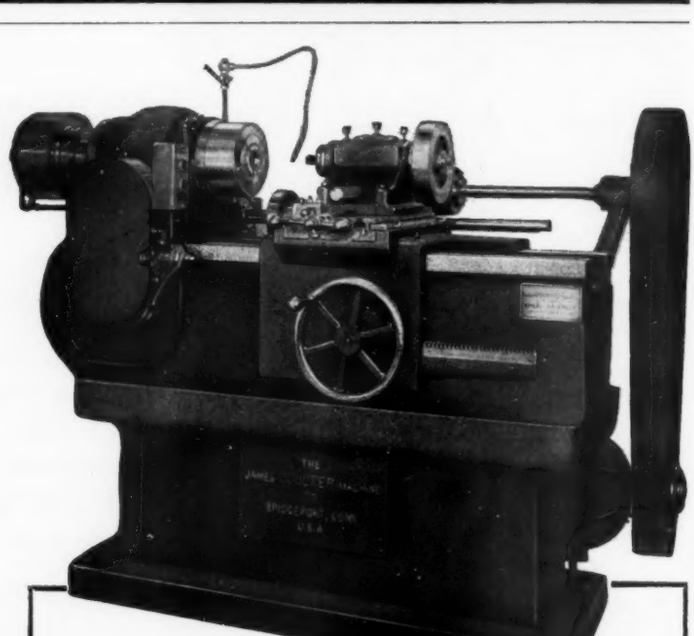
1437 Railroad Avenue
BRIDGEPORT, CONN.

Keep Ahead of DEFENSE DEMANDS *on the PRODUCTION of* EXTERNAL and INTERNAL THREADS

The Coulter Type "H" Hob Thread Miller—modern in every detail of design and construction—handles high speed, accurate production of right or left hand threads. Any parts that can be held in ordinary chucks, air operated chucks, air operated collet chuck or special face plate fixture can be threaded on this machine.

Work holding spindle and cutter spindle are driven by individual motors through worm and gears. Speed changes to work spindle are accomplished by pick-off gears; cutter spindle speeds are controlled by variable motor sheave. All high speed shafts turn in anti-friction bearings.

Maximum external thread, 7"; minimum hole depends on smallest hob practical.

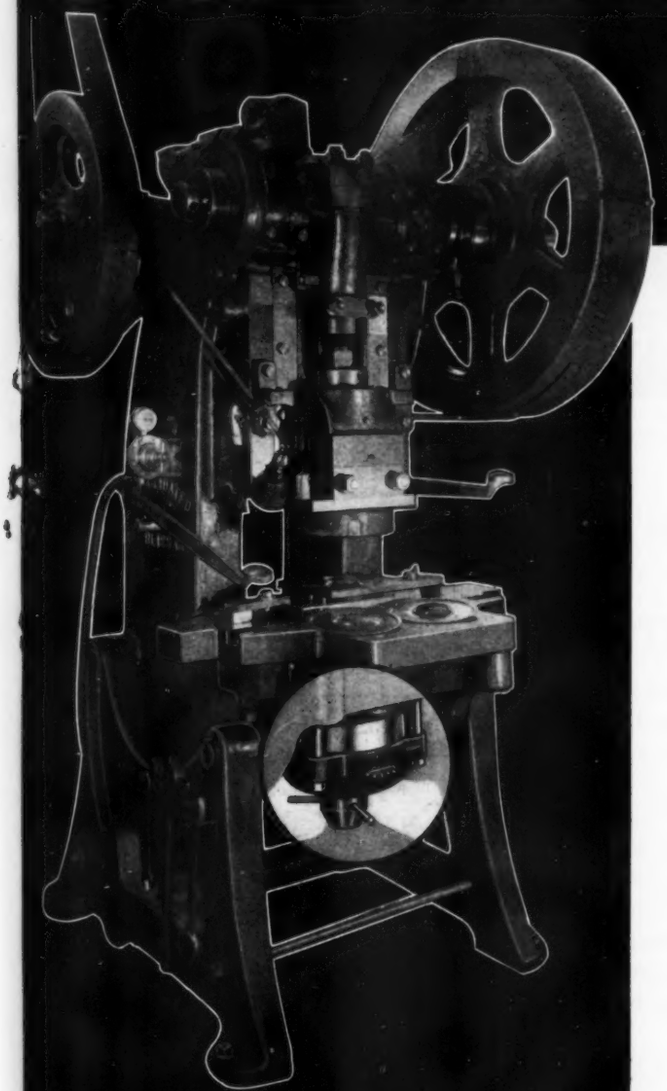


Send for Descriptive Bulletin giving full information.

The James **COULTER** *Machine Co.*
BRIDGEPORT • CONNECTICUT • U.S.A.

HOW TO DO MORE WORK WITH A PUNCH PRESS

USE OUR NEW IMPROVED UNIVERSAL PNEUMATIC DIE CUSHION



Deep Drawing Work Can Now Be Done on Any Standard Punch Press.

Our *New Improved Universal Pneumatic Die Cushion* can be used for all *deep drawing operations,* including pressure pad control on all forming dies.

Send us prints of your work for helpful, specific recommendations on any of your drawing or forming requirements—no obligations.

Write today for complete engineering catalog of representative installations of pneumatic die cushions on all deep drawing and pressure pad control work.

Immediate delivery on trial basis.

Equip your present Punch Press with a Pneumatic Die Cushion for as low as $50.

DAYTON-ROGERS MFG. CO.

830-13th AVENUE SOUTH, MINNEAPOLIS, MINNESOTA

★ ★ STEP UP PARTS PRODUCTION AT LOW INVESTMENT COST

. . . with the

NICHOLS HAND MILLING MACHINE

Substantial savings in production milling are assured by the Nichols Hand Miller—a precision machine which combines the usual features of conventional hand millers with the ruggedness and in-built accuracy of modern high production machine tools.

OUTSTANDING FEATURES INCLUDE:

. . . one piece box section column with adequate slides for head and knee integrally cast

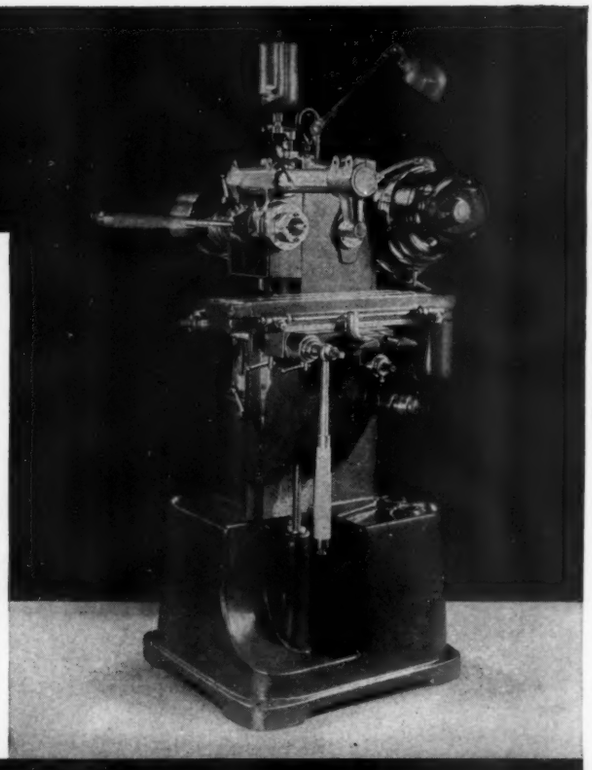
. . . heavy box section. Knee with extra long dovetail slides for both vertical adjustment and horizontal traverse

. . . table, fitted with oil pockets at ether end can be operated from either side of machine and locked in any position; standard equipment includes micrometer table stops; table feed screw optional.

. . . hand operated vertical head fitted with hand set depth stop; can be locked in any position.

. . . spindle hardened and ground mounted on Timken Precision Roller Bearings

. . . capacity: longitudinal feed 10"; traverse feed 7".



» WRITE FOR COMPLETE DETAILED SPECIFICATIONS «

W. H. NICHOLS & SONS *Waltham, Mass., U.S.A.*

CARD TAPS

DO YOU JUST BUY TAPS *or* DO YOU LOOK FOR BETTER TAP PRODUCTION?

For 67 years, Card has solved many problems for tap users. Outstanding advances in tap making and tap design have enabled Card to offer superior quality tapping as well as faster work—benefits that you, too, can realize through putting the right Card Taps to work on your production tapping. Why overlook possibilities for improvement in tapping by just merely buying taps. Call on Card engineers to help you select the taps that will assure better performance.

SEND FOR CATALOG 34.

Car Taps are sold by leading dealers everywhere

S. W. CARD MANUFACTURING CO.

Mansfield, Mass., U. S. A.

DIVISION OF UNION TWIST DRILL CO.

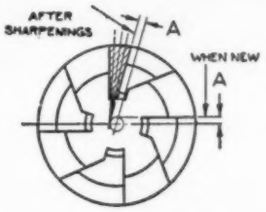
STORES: New York: 61 Reade St., Chicago: 11 South Clinton St.
Detroit: 6540 Antoine St., San Francisco: 121 Second St.
Seattle: 568 First Avenue, South
Los Angeles: 524 East Fourth Street

WASTE NOT... WANT NOT

Grinding face on saucer wheel

"*Acorn*" Dies will cut perfect threads until repeated sharpenings have ground away more than half of the lands. Now that universal demand makes it hard to get all the dies you need, be sure you get full value from your present stock—by using them until further grinding is not practical. Here's the way to sharpen them so they will last longest and cut best.

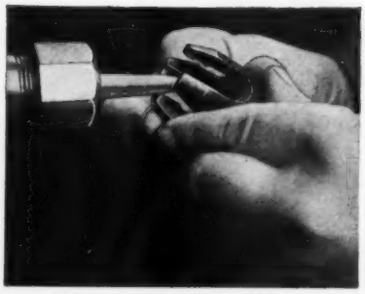
To grind the cutting face hold the die as in the illustration and grind the cutting face on a saucer wheel. Take light cuts so as not to burn the threads. Maintain the original angle of the cutting face with relation to "center" (see diagram). See that the same amount of metal is removed from each land.



When grinding the face, maintain original cutting angle this way

Grind the chamfer at the die's throat with a pencil wheel. (See below.) Put a slight relief on the chamfer; that is, remove more metal toward the heel than at the face. Use a solid rest for your hands to hold the die steady.

Special holders can be obtained for the smaller size dies which are difficult to handle.



Grinding chamfer with pencil wheel

If properly ground, the die will still cut perfect threads, even though the lands are quite thin.

Actually "*Acorn*" Dies are very easy to sharpen and a little practice will enable anyone to do a good job and double or treble their normal life.

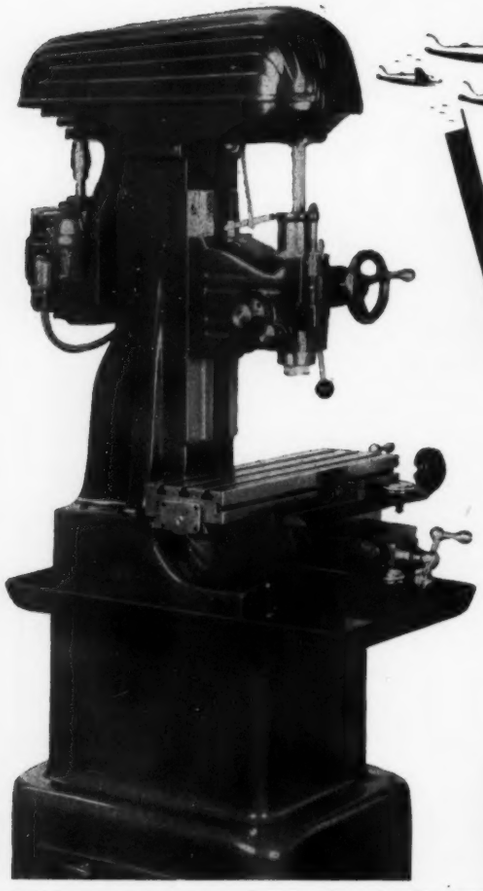
This is one of a series of advertisements published by Greenfield Tap and Die Corporation to help users get greater production from their small tools in these critical times, through making useful facts more widely known

GREENFIELD TAP AND DIE CORPORATION • GREENFIELD, MASS.

DETROIT PLANT: 2102 West Fort St.
WAREHOUSES in New York, Chicago and Los Angeles
In Canada: GREENFIELD TAP AND DIE CORP. OF CANADA, LTD., GALT, ONT.

GTD GREENFIELD

TAPS • DIES • GAGES • TWIST DRILLS • REAMERS • SCREW PLATES • PIPE TOOLS



"Bombsight" ACCURACY

THE VERNON VERTICAL MILL AND JIG BORER

A battery of Vernon Vertical Mills is now being used to manufacture America's precision bomb sight—conclusive proof of the precision performance and versatility of this outstanding tool. Other large quantity installations are doing precision milling operations on automatic rifles and machine guns in various small arms factories.

Here are some of the Vernon features that make such performance possible . . .

Spindle is nickel-moly steel mounted in ultra-precision, preloaded ball bearings ● Collet end of spindle is carburized, hardened and ground ● All dovetailed slides have tapered gibs ● ***Dial indicators*** *and* ***measuring rods**** *assure precise layout work ● 8 spindle speeds—250 to 4000 r.p.m.*

These and many other important features make the Vernon the most acclaimed vertical mill in the United States today! Write for descriptive folder and see the Vernon line at your dealers.

*Standard extra.

MACHINERY MANUFACTURING COMPANY
1815 EAST 51 ST. VERNON LOS ANGELES CALIFORNIA
Vernon Line of HORIZONTAL MILLS, VERTICAL MILLS and JIG BORERS, SHAPERS and GRINDERS

TAKE THE BOTTLENECKS OUT OF YOUR COLD METAL SAWING OPERATIONS

Cut your 3 inch and larger stock on the PORTER-McLEOD *and save time*

This new machine provides an economical means of handling your cutting off operations on a high production basis. More cuts, greater accuracy and lower operating and maintenance costs are outstanding advantages offered you by the 8" Porter-McLeod Cold Metal Sawing Machine.

This machine is recommended for general work and for production work in single or multiple units. Its capacity permits of "nesting" bars and shapes using the Porter-McLeod systems of "multiple or interchangeable nests" which provide support for each nest on both sides and bottom. By this method of nesting of bars and shapes, multiple units can be cut at one time and work speeded up.

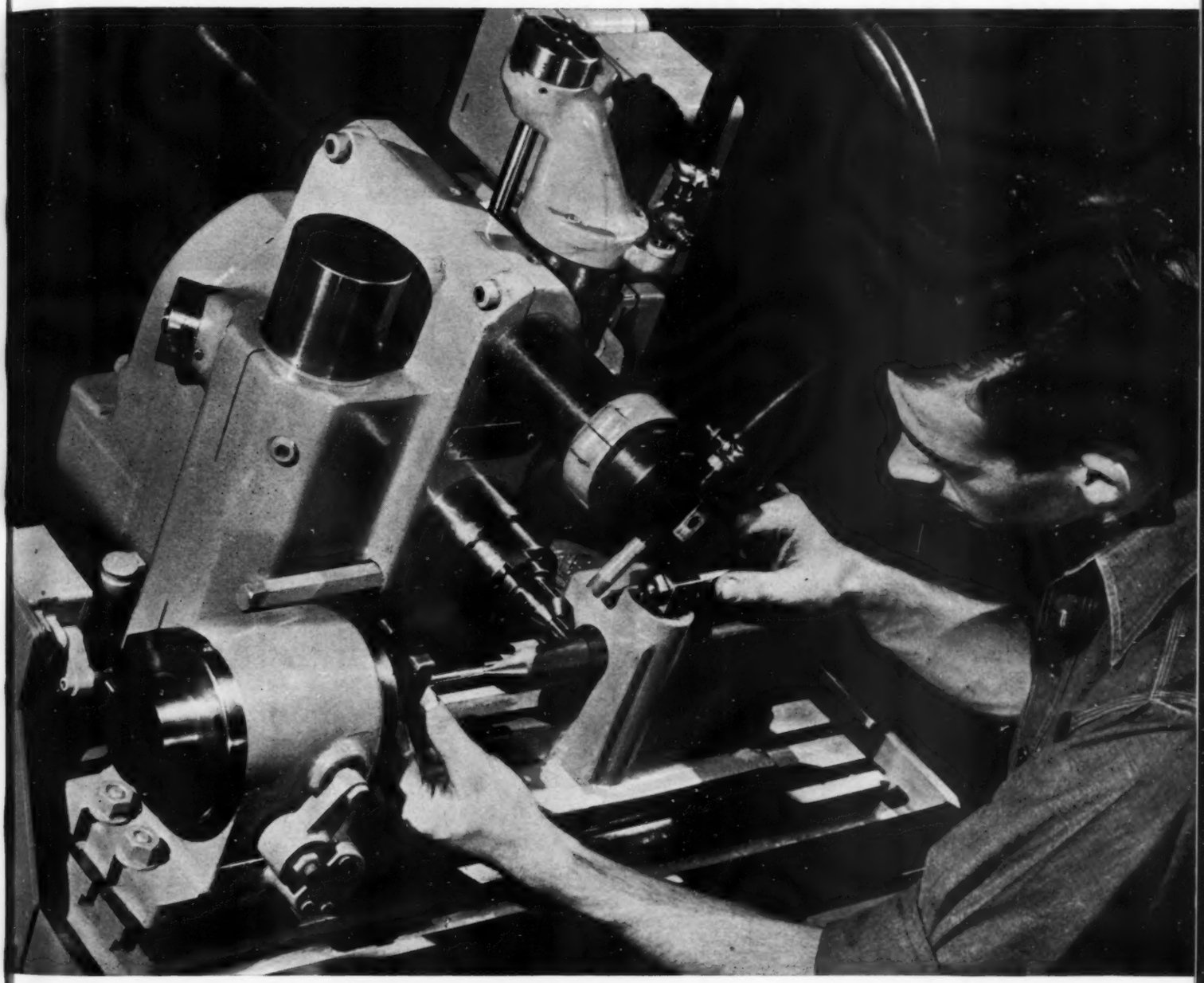
Ability to cut stock from 3 inches and up at high speed and with straight cuts is made possible by the Porter-McLeod method of pulling the blade upward through the stock and by supporting the blade, front and back on diameters well out from the center where support is needed.

These and other outstanding valuable features are fully described in engineering bulletin available on request. Send for your copy TODAY!

PORTER-McLEOD MACHINE TOOL CO., INC.
HATFIELD, MASS., U. S. A.

MACHINE TOOL COMPANY

PRODUCTION *plus accuracy* WILL WIN THIS WAR



Get Both in KENT-OWENS

Milling Machines

Production will win the War... *But ACCURACY cannot be sacrificed!* And everywhere experienced shop men are calling on Kent-Owens for milling machines to do the tough jobs. Kent-Owens Milling Machines are *rugged... simple... efficient.* They provide the advantages and features that practical men want. Send for Bulletin... Kent-Owens Machine Company, Toledo, Ohio.

SENSATION
of Two Shows!

PORTER-CABLE
WET-DRY G-8
THE PRECISION BELT GRINDER

Gives Speed Plus Accuracy to Within .0005"
Cuts Production Costs
Minimizes Rejects
Does Many Precision Jobs Without Fixtures
Relieves & Supplements Major Machines

AT the National Metal Show and earlier at the Tool Engineers Show, Porter-Cable G-8 proved that speedy wet belt grinding is now **precision** grinding!

Hundreds of "hard-boiled" production men crowded around our demonstration booths—wanting to be shown "belt-machining"—bringing their own samples of hard and soft metals, alloys, plastics, hard rubber—virtually **daring** us to put our machine to the test.

And we did just that! Free-hand work we held to .001"—and where they wanted **close** tolerances we held limits of .0005" or better! Heating, warping, discoloration and dust were entirely eliminated. Some jobs formerly done on millers with fixtures, we did free-hand **five to twenty times faster!**

Right now, Porter-Cable Wet-Dry Grinding is a godsend for relieving and supplementing your major machine tools. See it perform—on your own jobs. We'll demonstrate whenever convenient to you. Arrange appointment. Write us direct or phone your local Porter-Cable representative today.

5 to 20 TIMES FASTER BY ACTUAL DEMONSTRATION

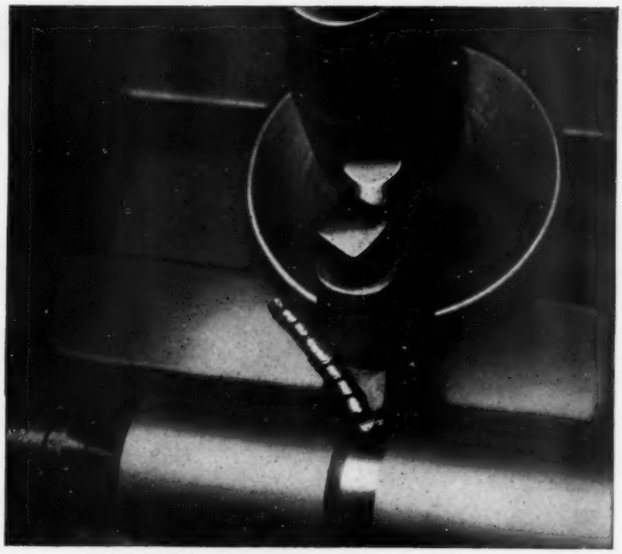
See it during January, demonstrated in Milwaukee, Davenport, Rock Island, Des Moines, Kansas City, St. Louis, Springfield, Ill., Indianapolis, Dayton, O.

For time and place, call your local Porter-Cable representative.

FREE
3rd Edition

"Wet-Dry Belt Grinding In the Spotlight," tells Where, When and How to use this new high-speed type of precision belt grinding. Write for your free copy *today!*

PORTER-CABLE MACHINE COMPANY
Representatives in Principal Cities in U.S.A.
1725-1 N. Salina St. Syracuse, N. Y.



SPECIALISTS

● Choosing the right company for the right job is as important as any mechanical operation. We ARE specialists in designing and manufacturing machinery.

ENGINEERS
M. L. BAYARD & CO.
INCORPORATED
MACHINISTS
PHILADELPHIA

Utilize that Narrow Space!

and save valuable floor and wall space. Where room is not available for a standard width panelboard, the

FA Type AC Circuit Breaker
COLUMN TYPE PANELBOARD

is the answer. It may be placed between the flanges of an 8", 9" or 10" H column—between windows—or in any other narrow space. There it is up off the floor, out of the way.

Built of standardized units, the FA Column Type Panelboard affords automatic protection against sustained overload, and prevents interruption of service from momentary overload. In the case of a short circuit, or sustained overload, service is quickly restored (after the cause has been removed) simply by moving the handle to the ON position.

Furnished for either single-phase, 3-wire, 115/230 volt or three phase, 4-wire 120/208 volt solid neutral service—with 4 to 42 single-pole branch circuits.

Ask for Bulletin No. 62

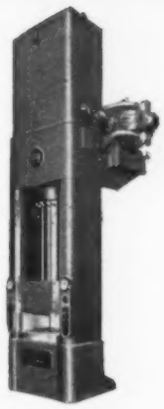
(Illustrated at left: Cat. No. NAC1BC-3L1O—Column Type Panelboard, with Wire Duct and Pullbox)

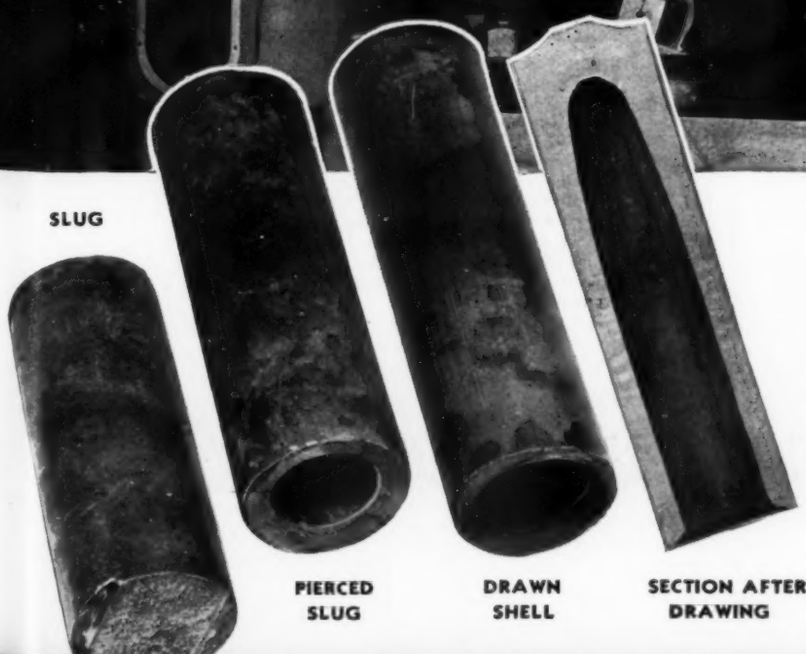
Frank Adam
ELECTRIC COMPANY
ST. LOUIS

High Explosive Shells Precision Forged on

H-P-M FASTRAVERSE PRESSES

With Minimum Rejects





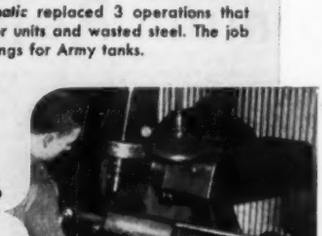
● **H-P-M FASTRAVERSE FORGING PRESSES** are being effectively employed by prominent munitions makers . . . producing precision shell forgings . . . 75 mm and larger. Actual production records show high net outputs with 96% of the forgings meeting the rigid inspection standards. ● **H-P-M PRESSES** are modern designs, self-contained, with individual motor drive. Economical to operate and maintain. Available complete with piercing and drawing dies. » » »

THE HYDRAULIC PRESS MFG. COMPANY
Mount Gilead, Ohio, U. S. A.
District Sales Offices: New York, Syracuse, Detroit and Chicago
Representatives in Principal Cities

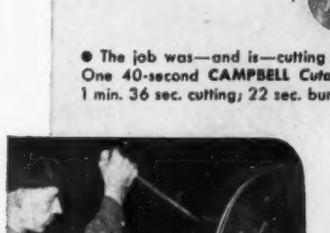
75% OF CUTTING COSTS ARE SAVED

● One **CAMPBELL** *Cutamatic* replaced 3 operations that required 4 times the labor units and wasted steel. The job was—and is—cutting springs for Army tanks.

76% OF CUTTING COSTS ARE SAVED



● The job was—and is—cutting tubing for 25 mm. shells. One 40-second **CAMPBELL** *Cutamatic* operation replaced 1 min. 36 sec. cutting; 22 sec. burring, 55 sec. machining.



REDUCES COST OF CUTTING 90%

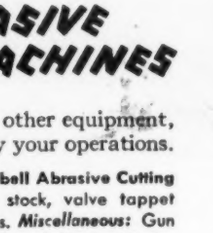
● The job was the cutting of spacers from 2¼ x 1¼ silicon manganese bar stock. 20 seconds on a **CAMPBELL** replaced 20 minutes of the other methods—and saved the need for annealing.

These Savings were made by using

Campbell ABRASIVE CUTTING MACHINES

If you are cutting metal with any other equipment, ask to have a Campbell man study your operations.

Among Defense work being cut on Campbell Abrasive Cutting Machines: ***Aircraft:*** Crankshafts, valve stock, valve tappet guide, pistons. ***Tanks:*** Crankshafts, springs. ***Miscellaneous:*** Gun barrel and machine gun stocks; armor plate (tests), forging blanks. **Work being cut on Campbell Nibblers:** Sheet stocks, tubing, gas and oil tanks for *Aircraft* —motor truck bodies, armored truck bodies, etc. for the *Army*.



Write for a copy of this interesting booklet: "DESIGN FOR CUTTING COSTS"

ANDREW C. CAMPBELL DIVISION
BRIDGEPORT • CONNECTICUT
In Business for Your Safety

AMERICAN CHAIN & CABLE COMPANY, Inc.

UNIVERSAL

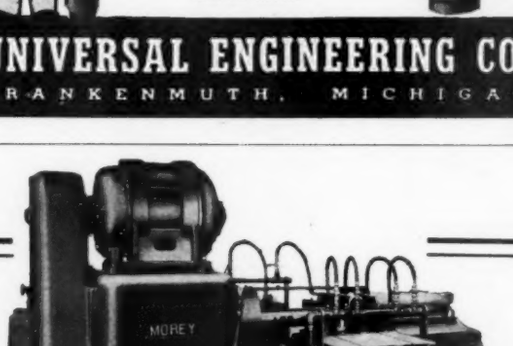
CENTERING CHUCKS AND FLOATING CHUCKS FOR SPEED AND ACCURACY

Universal centering chucks (left) make a centering machine out of a drill press. Accurate and sturdy. Depth adjustment for centers.

Both centering and floating chucks available for speedy delivery. Write for catalog.

Universal floating chucks (right) are designed to operate horizontally in automatic screw machines and turret lathes. Adjustable spring pressure in 4 directions prevents dogtail motion and marred holes.

UNIVERSAL ENGINEERING CO.
FRANKENMUTH, MICHIGAN



The "27" MOREY Semi-Automatic HEAVY DUTY LATHE

TIMKEN TAPERED ROLLER BEARINGS FOR THE MAIN SPINDLE—ALL OTHERS ANTI-FRICTION

Just the machine for Shell Work!

SEMI-AUTOMATIC: A Complete feeding and return cycle—

A single movement of the starting lever starts the spindle revolving and the tools feeding. When the work is completed, the tool is returned to the loading position, the spindle is stopped and the work is unclamped, ready for removal.

Rigid enough to use carbide tools to their full capacity.

The Lathe is entirely self-contained—no outside or auxiliary equipment required.

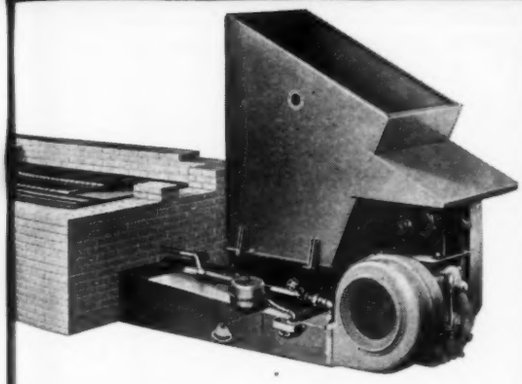
Ask for Circular No. 715

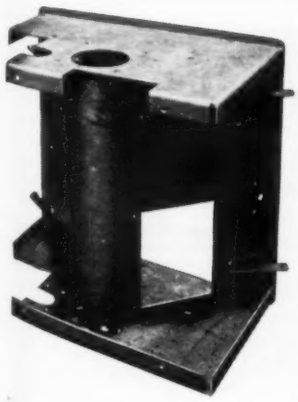
MOREY MACHINERY CO., INC.
410 Broome Street New York, N.Y.

Forming IRON FIREMAN Stoker Parts

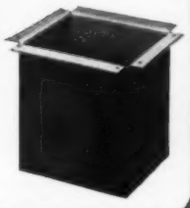
This press has been in continuous service for 5 years . . . 8 to 24 hours a day

Flanging three different edges of Heatmaker panels (16 gauge steel) at each stroke of the press.





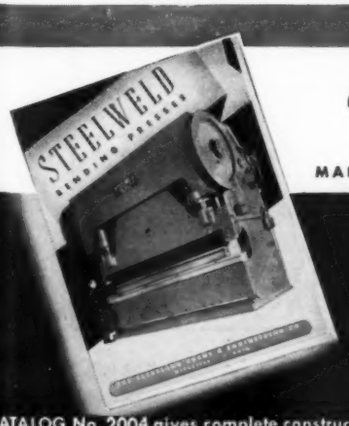
The many bends for parts of Iron Fireman Stokers and Heatmakers are made on the Steelweld Press above. Plate from 24 gauge to ⅜" are handled with this machine.



Since installed five years ago, a Steelweld Bending Press has been doing the forming and braking work required for the various parts of Iron Fireman Stokers and Heatmakers. The metal for these parts ranges from 24 gauge to ⅜ inch in thickness.

The great demand for Iron Fireman heating equipment has kept the press working continuously from 8 to 24 hours a day. At all times it has performed with complete satisfaction.

In plants throughout the land Steelwelds are increasing production, lowering costs and improving product appearance. Because of the all-welded one-piece frame, extra large bearings and heavy construction of all parts, Steelwelds can be depended upon for trouble-free service. If your work requires operations such as bending, forming, blanking and multiple-punching, investigate the possibilities of a Steelweld Press. Standard line available for metals up to 20'-0" wide or one inch thick.



GET THIS BOOK!

CATALOG No. 2004 gives complete construction and engineering details. Mail request for free copy on your company letterhead.

THE CLEVELAND CRANE & ENGINEERING CO.
STEELWELD MACHINERY DIVISION
1127 EAST 283RD STREET • WICKLIFFE, OHIO.

MANUFACTURERS OF • CLEVELAND CRANES • CLEVELAND TRAMRAIL • STEELWELD BENDING PRESSES

STEELWELD
BENDING PRESSES

GENERAL SALES AGENTS: CYRIL BATH & CO., E. 70TH & MACHINERY AVE., CLEVELAND

CONTRACT WORK

Advertisements on this and the following page are placed here by well-known concerns doing work on a contract basis. When you need assistance write to these established manufacturers.

• Machines and Parts, • Special Tools and Fixtures, • Cam Milling, on Contract

Your engineering problems will receive efficient and economical service in our modern plant manned with skilled workers. Contact us today for prompt quotations on your blueprints or samples.

Designers and builders of wire and ribbon stock forming machines.

THE A. H. NILSON MACHINE CO., BRIDGEPORT, CONN.

SUB-CONTRACT FACILITIES FOR

Non-ferrous hand screw machine products.

Engine and bench lathe, milling and drill press work.

Small sheet metal fabrications to closer than commercial tolerances.

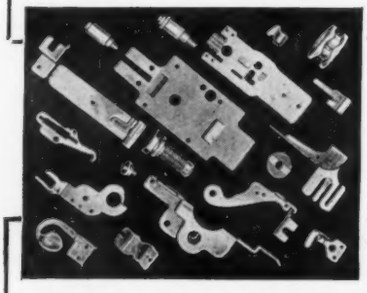
Stampings.

We do our own tooling.

RELIANCE MACHINE & MFG. CO.
Thirty Irving Place New York City
36 years experience in metal fabrication.

STAMPINGS AND ASSEMBLIES

Fast Service on Long or Short Runs



"GREATER SAVINGS WITH GREIST"

We can handle your stamping and assembly requirements in any metal. Our modern equipment and methods coupled with 50 years of experience is your guarantee of accuracy and efficiency. Our facilities include capacity for handling screw machine products, tools, dies, jigs and fixtures.

Quality work by skilled mechanics is assured. Send your blueprints or samples today for prompt quotations!

THE GREIST MFG. CO.
546 BLAKE ST. NEW HAVEN, CONN.

METAL STAMPINGS

• TOOLS • DIES •

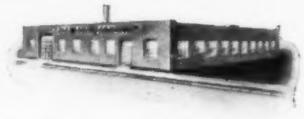
PERMANENT MAGNETS

HEAT TREATING

THOMAS & SKINNER STEEL PRODUCTS CO.

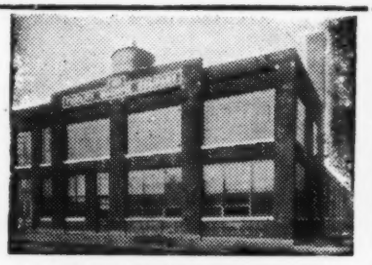
1103 E. 23rd St. INDIANAPOLIS, IND.

SPECIAL MACHINES



Light and Medium Machine Work, Lathe, Milling Machine, Shaper, Drill Press, Hand Screw Machine, Power Press, Cylindrical Grinder and Bench Work.

HAIDA ENGINEERING CO.
34-11 Vernon Blvd., Long Island City, N. Y.



MACHINISTS AND ENGINEERS
FIDELITY
MACHINE COMPANY
1908-18 Frankford Ave., Phila., Pa.
Jefferson 7600-1-2

Need steel balls — **for defense assemblies ?**

The Abbott Ball Company
1042 New Britain Ave., Hartford, Conn.

ABBOTT BEARING BALLS

KIRK & BLUM

WELDED MACHINE BASES, PEDESTALS and FRAMES

LATHE PANS

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Pressed Steel Louver Panels and Cover Plates

THE KIRK & BLUM MFG. CO.
2823 Spring Grove Ave., Cincinnati, Ohio

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Hundreds of metal-working companies are finding profitable business today *outside* their regular lines.

You, too, can put your idle machines and equipment to good use by directing attention to them through American Machinist's CONTRACT WORK SECTION.

American Machinist's net paid circulation of over 21,000 reaches the men who need and can authorize sub-contracting.

Tell your story to these men through American Machinist's CONTRACT WORK SECTION. We will gladly send you complete information at no obligation.

CONTRACT WORK DEPARTMENT
AMERICAN MACHINIST 330 W. 42d St., New York, N. Y.

CONTRACT WORK

Advertisements on this and the following page are placed here by well-known concerns doing work on a contract basis. When you need assistance write to these established manufacturers.

HONING CAPACITY AVAILABLE

BARNESDRIL — Honing Headquarters — now has capacity available for cylindrical honing on contract

Working 'round the clock building Barnesdril Honing Machines, Hydrams and All-Geared Drilling Machines demanded enlargement of all departments . . . including our Jobbing Department which hones hydraulic cylinders, pneumatic cylinders and other parts used in our own and other products. Some of this contract honing capacity is available now to additional manufacturers requiring honing on a contract or jobbing basis.

High Speed, Close Limits, Fine Finish . . . Barnesdril Honing cuts bored or reamed surfaces to final diameter, truly round, straight from end to end — holds tolerances in thousandths or "tenths" as required — provides very fine finish, dull or brilliant as desired . . . gives you *all* these qualities *faster* than any other single machining method.

Wide Range . . . Barnesdril Honing is used extensively in finishing parts for airplanes, automobiles, artillery, engines of all kinds, guns, tanks, tractors, trucks and other products . . . has many possible new uses. Barnesdril Honing Machines are built in various sizes for work of any diameter or length. Our Contract Division equipment will hone work-pieces up to 25 feet long, and any diameters for which hones are available or can be obtained.

Investigate . . . Write us, today. Ask for Bulletin 121-A. Send drawings and complete data on your work for free consulting service and specific quotations.

Barnes Drill Co. 830 CHESTNUT STREET ROCKFORD ILLINOIS, U.S.A.

SMALL DIES AND STAMPINGS
Progressive Blanking & Forming Dies
Small Stampings and Assemblies
• ALOFS MANUFACTURING CO. •
1617 Madison Ave., S.E. Grand Rapids, Mich.

WIRE AND METAL SPECIALTIES
In round, flat, square and special shaped wire in all metals.
LARGE PRODUCTION CAPACITY
Plating and finishing.
EASTERN TOOL & MFG. CO.
BLOOMFIELD, N. J.

PATTERNS in WOOD and METAL
For All Kinds of Castings, Large or Small
MATCH PLATE WORK A SPECIALTY
Put your pattern problems up to us—we will take care of them—ask the foundries about our work—they use our patterns every day.
GENERAL PATTERN WORKS
2233 Buck Street Cincinnati, Ohio

COMPLETE MANUFACTURING FACILITIES for DEFENSE WORK

Patterns; Match Plates; Castings; Dies; Sheet Metal Stamping, Welding and Assembly; Tool Work.

Two plants strategically located at Baltimore and Jersey City, staffed with skilled workers, completely equipped for large production of complete assemblies, or parts only. Can handle all stages of production . . . patterns, match plates, cored or regular castings; dies, jigs, fixtures, sheet metal stampings (40 presses up to 200 tons), punching, welding, drilling, sub-assembly, assembly.

Semi-production work requiring planers, millers, shapers, lathes, large radial and other drill presses. Machine tool work such as tools, dies of small or large size.

Let us help you with your defense production problems.

WRITE TODAY for a complete, detailed survey booklet of our plant facilities.

No obligation of course

STANDARD GAS EQUIPMENT CORPORATION
18 East 41st St., New York Bayard & Hamburg Sts., Baltimore

AUCTION! AUCTION!

VALUATION $300,000.00

Sale on Wed. & Thurs, January 21 & 22, 1942

commencing 10:30 each day at 708 Broadway, New York, N. Y.

MILL SUPPLIES

14,300 High Speed Milling Cutters such as Slide, Plane, Interlocking, Angular, Form, Radius, Slotting and slitting milling cutters from 2 to 6 inches.

21,000 High Speed End Mills, Keyway cutters and double end mills in various sizes.
Large quantities consisting of hollow mills, Arbors, chucks, vises, Electric Drills, grinders, machinists tools, Micrometers, calipers, dividers, surface gauges, clamps, combination squares, ball pein hammers, feelers, wrenches, etc.

5000 High Speed Drills in various sizes, high speed hack saw blades, taps, dies, reamers, files. 200 milling machine & bench vises plain and swivel. 50 Pratt & Whitney oil pumps. 1000 lbs. fine gauge wire and many other items too numerous to mention.

INSPECTION MONDAY & TUESDAY JAN. 19 & 20th, 1942

All to be sold in single lots without limit or reserve.

DESCRIPTIVE CATALOG UPON REQUEST.

S. KNITZER & SON, *Auctioneer & Liquidators.*

SAMUEL KNITZER, *Auctioneer,* **708 Broadway, N. Y. C.**

ATTENTION: *The above Material is one of the largest stocks of this kind ever offered at Public Auction, and should interest Mill Supply dealers, Machinists tool dealers and Industrial plant buyers.*

POSITIONS VACANT

MACHINE DESIGNER: Position open for first-class machine designer of proven ability, experienced in the design of modern machine tools. This position is steady for the right man. Applicants must be citizens of the United States. Location: Rhode Island. P-155, American Machinist, 330 W. 42nd St., New York, N. Y.

HIGH SPEED STEEL METALLURGIST to take charge of heat treating department of rapidly expanding small tool manufacturer. Steady business now employing about 300 offers exceptional opportunities. Metallurgist must be capable at directing research work in hardening small high speed tools. Age preferred 25-35. Starting salary $4000.00 and bonus. Location Middle West. P-165, American Machinist, 520 N. Michigan Ave., Chicago, Ill.

PRODUCTION ENGINEER: starting salary $6,000.00 per year. Should be a graduate of an accredited mechanical engineering school, 30 to 35 years old, to be in charge of all engineering and planning activities for an old, well-established, financially sound company in the Chicago area, making a nationally distributed, high precision product, a substantial percentage of which is defense work. Applicant should have had mass production experience, preferably on precision work; should have a combination of executive and engineering ability. Reply to P-166, American Machinist, 520 N. Michigan Ave., Chicago, Ill.

FIRST CLASS MACHINE TOOL ENGINEER who has had experience in selling wanted. Splendid opportunities for advancement. Give age, experience and salary expected. P-167, American Machinist, 330 W. 42nd St., New York, N. Y.

POSITIONS WANTED

PLANT EXECUTIVE—N. Y. State Licensed Engineer, 52. Experience: Plant management, production, inspection. U. S. Army Ordinance and U. S. Navy Armor. PW-168, American Machinist, 330 W. 42nd St., New York, N. Y.

SUPERINTENDENT OF MAINTENANCE of large ordnance plant desires change. Have high executive ability as well as thorough knowledge of shop practice and machine tool operation. Can handle production as well as maintenance or both. PW-169, American Machinist, 520 N. Michigan Ave., Chicago, Ill.

MECHANICAL ENGINEER, Processing, tool design, and tool making production control. Shells, Artillery, instruments. PW-170, American Machinist, 330 W. 42nd St., New York, N. Y.

CONTRACT WORK

WORK WANTED—For advertisements of work wanted see names indexed under Contract Work in the Searchlight Section Index appearing on the page Facing the inside back cover.

PATENT ATTORNEY

PATENTS—Booklet free. Highest references. Best results, Watson E. Coleman, Patent Lawyer, 724 Ninth Street, Washington, D. C.

PATENTS, COPYRIGHTS. Booklet, "General Information Concerning Inventions and Patents" and "Fee Schedule" sent without obligation. Established 1915. Lancaster, Allwine & Rommel, Suite 453, 815-15th St., N.W., Washington, D. C.

PROFESSIONAL SERVICES

Machine Tool Designing Engineers

30 Years Experience in Designing Building & Developing Production Machinery & Processing Operations

Automotive — Tractor
Airplane — Munitions

1115 E. 35 St., Indianapolis, Indiana

W. K. Millholland Machinery Co.

WANTED

INVENTIONS WANTED

Practical mechanical or electrical inventions promoted, and carried to manufacture.

Mail all available information to

P. O. Box 217, Denville, N. J.

WANTED

Taps-Twist Drills-Files-Cutters-End-mills-Saws-Hack Saw Blades

We Will Buy Your Surplus Tools

WESTERN TOOL EXCHANGE
619 W. Randolph St. Chicago, Ill.

FOR SALE

(Additional For Sale Advertisements on pages 121-127)

FOR SALE

LINDBERG FURNACE

Oven size—24" high, 20" wide, 44" deep. Tubulaire type T 18-36-18. 230 Volts. 30 KW. Only used short time.

Write:

ARCO-MARATHON CORP.
Marathon, N. Y.

Found! UNUSED MACHINE HOURS

This is **No. 9** of a Series on Engineered Machine Tool Rebuilding.

Soldiers are not expected to remain in the thick of battle without let-up. They get furloughs and sick leaves. Machines, too, must retire temporarily.

"Behind the lines" for ailing machine tools is the Simmons rebuilding plant in Albany. Here mechanical disabilities are completely repaired. Here skilled craftsmen find unused working hours in used equipment . . . send them "back up front" good as new.

Ready to return to the production lines—a No. 3 Cincinnati vertical milling machine, rebuilt by Simmons for a large Southern Shipyard.

Send for This Book Today

If you want to know more about this method of increasing machine tool productivity, send today for a copy of the 58-page book, "The Simmons Way."

The above machine, after careful analysis by Simmons' Engineering Department, was thoroughly cleaned and dismantled. Then, expert mechanics completely rebuilt the machine, replacing bushings, gears, and other worn parts with new ones. When it had been reassembled, it was power-tested, and returned to its owner accompanied by a Certified Test Report and Simmons' Performance Guarantee.

Write for a Rebuilding Estimate on YOUR Tools.

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ENGINEERED
Machine Tool
REBUILDING

SIMMONS MACHINE TOOL CORP.
1759 NORTH BROADWAY, ALBANY, N. Y.
NEW YORK OFFICE: 149 BROADWAY

Re-MANUFACTURED MACHINE TOOLS
-(ORIGINATED BY US)-
Reg. U. S. Patent Office

BORING MACHINES
No. 2—5" Bar Barrett

BORING MILLS
42" Gisholt
14' Sellers, motor drive

DRILLS
1, 2, 4 spdl. Henry & Wright
No. 2—4 spdl. Leland-Gifford, Motor Spindles with Power Feed
1, 2, 4 spdl. Leland-Gifford
No. 2—1 spdl. Colburn
No. 5-D—4 spdl, Moline Hole Hog
No. 17—2 Spdl. Foote-Burt Rail
No. 4—5 spdl. Foote-Burt Rail
No. 1 Baush Multiple
No. 3 Baush Multiple

RADIALS
5' Western Heavy
8' Western Heavy

GEAR CUTTERS
No. 6, 61, 62, Fellows
No. 12 Barber-Colman
No. ½ Pfauter Hobber, M.D.
No. 3—26" Brown & Sharpe
No. 4—48" Brown & Sharpe
No. 5—48" Brown & Sharpe
No. 6—72" Brown & Sharpe
No. 6-A—72" Cincinnati
96" Newton Spur Gear
No. 368M G&E Bevel Rougher

GRINDERS
(See page 125 special advertisement Hill-Clarke Cylindrical Grinders)
No. 40 Bryant Plain, Wide Wheel, Oscillating
No. 2½ Universal (Bath Type)
No. 5 Springfield Planer Type Surface
No. 2—18" Gardner Disc

LATHES
3½"x36" Fitchburg Lo-Swing
3½"x60" Fitchburg Lo-Swing
3½"x108" Fitchburg Lo-Swing
8"x60" Fitchburg Lo-Swing
No. 4 AC Leblond Auto. Duplex Crankshaft
18"x6' Bradford Geared Head
20"—40"x10' Rahn-Larmon Geared Head Sliding Bed Gap
21"x8' LeBlond Universal
21"x10' LeBlond
24"x22' Lodge & Shipley, taper attachment
26"x10' Bridgeford
30"x12' Whitcomb-Blaisdell

MILLERS
No. 3 Becker-Brainard Plain Miller
Model CS Becker Vertical Continuous Rotary
5" P&W Automatic
24"x24"x12' Ingersoll Adj. Rail
24"x20' Ingersoll Dbl. Faced
36"x36"x12' Newton Duplex
38"x44"x20' Ingersoll Slab
No. 1 Smalley-General Thread

PLANERS & SHAPERS
24" Mark Flather, S.P.D. Shaper
24"x24"x6' Powell
24"x24"x6' Rockford
24"x24"x12' Gray
30"x30"x8' American
30"x30"x8' Powell
36"x36"x12' American
36"x36"x18' Cincinnati
42"x42"x14' Gray
48"x48"x10' Niles-Bement-Pond
48"x48"x12' Gray, Reversing M.D.

PRESSES
No. 303 Bliss Straight Sided
No. 58 Toledo Nosing
No. 42½ Pels Beam Shear

TURRET LATHES
21"x8' LeBlond Universal
2¼"x26" Greenlee, A.C. & B.F.
3¼"x40" Greenlee
3"x36" Jones & Lamson, 2 spdl.
3"x36" Pratt & Whitney, A.C. & B.F.
21" Gisholt, 3¾" H.S.
24" Steinle, 6¼" H.S.

MISCELLANEOUS
No. 7 Burr Keyseater
60" Quickwork Rotary Shear
No. 4 J. N. La Pointe Broach
6½" Avey Metal Band Saw
No. 12 Bignall & Keeler Pipe Machine

HILL-CLARKE MACHINERY COMPANY
651 Washington Blvd. Chicago

MOREY DEPENDABLE USED MACHINES

Ingersoll 24"x24"x12' Slab Miller
P & W 6"x132" Thread Miller
Cincinnati 18" Auto. Duplex Miller
McCabe 24"x42"x14' Double Spindle Lathe
Bridgeford 36"x40', 15 speed Geared Lathe
Sellers 42" Car Wheel Lathe
Foster No. 1F Fastermatic Turret Lathe
Natco No. 11 and No. 12 Multi Spindle Drills
Natco 13H Hydraulic Multiple Spindle Drill
Barnes No. 3 Horizontal Drill
Sipp 3 spindle High Speed Drill
Gleason 24" Bevel Gear Planer
Gleason 37" Bevel Gear Planer
Gleason 6"-11"-18" Bevel Gear Generators
La Pointe No. 2 and No. 4 Broaching Machines
Landis 3½" Internal Hydraulic Race Grinder
Heald Nos. 55-60-65 Internal Grinders
Bath No. 2 Universal Grinder
Norton 6x32 Plain Grinder
Landis 10x52 Plain Grinder
New Britain No. 22 Automatic Chucking Machine
Bliss No. 31 Geared Fly Wheel Press, M.D.
Bliss No. 5 Back Fly Wheel Press
Bliss No. 73½ Straight Side Press
Bliss No. 160 Single Stroke Crank Press.
Cleveland ⅜"; ½"; ⅝"; ⅞"; 1¼" Model "A" Automatic Screw Machines
Espen Lucas No. 138 Cold Saw—Cap. 12" Rd.
Newton No. 200 Cold Saw—Cap. 11" rd.
Cochrane & Bly No. 5 and No. 6 Cold Saws
Cleveland No. 1 Plate Planer—21' capacity
Woodward & Powell 30"x30"x8' Planer—single head
Acme 1" All Steel Upsetter
Ajax 3" All Steel Upsetter
Saunders 8"-18" Pipe Threader, M.D.

THIS IS A PARTIAL LIST

• *Write us* •
your Specific Inquiries

MOREY MACHINERY CO., Inc.
410 BROOME ST. NEW YORK

HIGH GRADE MACHINE TOOLS

LATHES
14"x6' Hendey Grd. Hd. S.P.D. T.A.
16"x8' South Bend Cone Drive, Q.C.
20"x8' American High Duty Cone, Q.C.
18"x8' LeBlond Cone, B.G.
18"x8' Greaves Klusman Grd. Hd. T.A. Q.C.
20"x17' Greaves Klusman Grd. Hd. T.A. Q.C.
20"x8' American Grd. Hd. M.D.
25"x16' LeBlond H.D. 3 S.C.D. D.B.G.
36"x20' Fifield Engine Lathe, Cone Drive.

GRINDERS
#55 Heald Internal Grinder, Belt driven.
12" Pratt & Whitney Surface Grinder, B.D.
14"x72" Queen City Self Contained Plain.
60"x60"x12' Pond H.D. 4 hds.
#5 Oliver Drill Grinder, Motor Driven.

GEAR CUTTERS
#3-26" B & S Gear Cutter.
#1 and 3 Adams Gear Hobbers.

BORING MILLS
42" Niles Bement Pond, H.D.

BOLT & PIPE THREADERS
2' Landis with Lead Screw Cone drive.
3" Landis Cone drive.
1" Acme Cone drive.
2" Landis Pipe Machine Cone drive.
2" Acme Cone drive.

RADIAL & UPRIGHT DRILLS
4'x6' Bickford Plain S.P.D.
20" Barnes 4 spindle drill.
26" Barnes All geared Tapping attachment.

SHAPERS & PLANERS
24" Rockford H.D. Back Geared Crank.
24" Steptoe H.D. Back Geared Crank.

CINCINNATI MACHINERY & SUPPLY CO.
217 East Second St. Cincinnati, Ohio

EXCEPTIONAL TOOLS

LATHES
30"x20' LeBlond, q.c. mtrzd.
18"x16' Flather, belt drive, quick change.
40 Lathes in stock, 12" to 54" swing

GRINDERS
12"x36" Pratt & Whitney Surface belt drive.
12"x36" Modern Plain Cylindrical, self contained.
20"x144" Landis Plain Cylindrical.

POWER PRESSES
#4 Federal Inclinable, 3" stroke, bed 27"x14¾", cap. 35 ton.
25 ton Henry & Wright h.s. Dieing Machine, 5⅛" single roll feed.

MISCELLANEOUS
20 spindle Natco, mtr. dr. #2 M.T.
#2 Baker Keyseater, belt dr. cap. 2"x20".

THE O'BRIEN MACHINERY CO.
113 N. THIRD ST., PHILA., PA.

1—#3 **Lodge & Shipley Duomatic Lathe**
1—12 x 18 **Cincinnati Plain Cylindrical Grinder,** M.D.
2—#70 **Heald Internal Grinders**
1—18" **Libbey Turret Lathe**
1—#2 **Cincinnati Surface Grinder**
4—8" **Sundstrand Stub Lathes**
1—#17 **Barber-Colman Gear Hobber**
1—15" **Gleason Pinion Roughers**
2—#6 **Bryant Chucking Machines**
1—#2 **Leland Gifford** Single Spindle **Drill Press**
1—#13 **Pratt & Whitney Multiple Drill,** M.D.

Your inquiries receive prompt attention

CENTRAL MACHINE TOOL CORPORATION
122-126 Nebraska Ave. Toledo, Ohio
Adams 1914

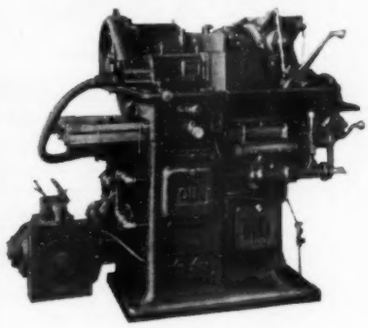
OTT MACHINERY SPECIALS

AUTOMATICS, Acme #56—2¼" 4 spdle.
AUTOMATICS, Cleveland 4½" Model M Chucker
AUTOMATICS, Cleveland, 3¼" Model A, M.D.
AUTOMATICS, Gridley, 2¼, 3¼ & 4¼" S.S.
BORING MILLS, Bullard, 42" 2 Swivel Heads
BORING MILLS, Niles, 54" 2 Swivel Hds.
GRINDERS, B.&S. #2 & 3 Universal
GRINDERS, Landis, 10x36" Self Contained
GRINDERS, Landis, 16x72" Plain
GRINDERS, Norton, 10x24 & 36" Plain
LAPPER, Norton #15 Vertical, M.D.
MILLING MACHINES, Becker Vertical, #4B, Model B1—M.D. & C5.
PLANERS, 30x30x8' Cti-44x44x18' Niles
PRESSES, Toledo, #34 Solid Back, S. G.
PRESSES, Ferracute, P2, 3 & 4, Solid Back.

OTT MACHINERY SALES, INC.
542 Second Ave. Detroit, Mich.

DEPENDABLE "FALK"

#12 Greenfield Hydromatic INTERNAL GRINDER



LATHES

42"x25' POND Heavy Triple Grd, belt dr.
27"x20' LODGE & SHIPLEY, Patent Head
26"x15' GREAVES KLUSMAN, Pl. Change with Raising Blocks to swing 48"
26"x12' CRAWFORD ERIE Heavy Duty Lathe, quick change gear.
25"x12' LEBLOND Heavy Duty, Taper Attach.
20"x8' AMERICAN, QCG, Motor Drive
20x10 DAVIS, QCG, cone drive
21"x8' LEBLOND, turret on carriage
18"x12' PRENTICE, cone
18"x12' HAMILTON, cone
18"x8' LEBLOND Production, QCG
18"x8' MUELLER, QCG, cone
18"x8' CHARD cone
18"x8' CISCO, QCG, cone
17x8' SIDNEY
16x8' CINCINNATI, QCG, cone
16x8' CINCINNATI, QCG, taper
16x6' LODGE & SHIPLEY Geared Head
16x6' AMERICAN Geared Head
16x6' PRATT & WHITNEY cone
16x6' MONARCH, QCG, cone
16x6' LODGE & SHIPLEY, QCG, cone
14x6' ROCKFORD, QCG, cone
14x6' STANDARD LATHE WORKS, Pl. cone
14x6' MONARCH, QCG, cone
13x6' PRATT & WHITNEY Model "B" gagemaker
13x5' MULLINER, QCG, cone
13x5' MULLINER, QCG, taper, dr. bar
4"x104" L-swing, 4"x60", 4"x48"
10"x42" LOGAN (new)

HORIZ. BORING MILLS

#0 GIDDINGS & LEWIS 3" bar
#32 GIDDINGS & LEWIS 3⅛" bar (2)

RADIAL DRILLS

5' FOSDICK, Univ.
4' N.B.P. Semi-Universal, 11" col.
3' BICKFORD, 9" column
3' CARLTON, Sensitive, B.B.; M. D.
3' AMERICAN, Sensitive

DIE CASTING MACHINES

3—MADISON-KIPP 500# pressure; Gooseneck #5; sizes: 10x12; 12x14; 12x16. Late models—Bargains

FORGING PRESS

#4 BLISS, with taper rolls
#75½ BLISS Geared

VERTICAL BORING MILLS

60" NILES BEMENT POND, M.D.

LARGE PLAIN MILLER

#4 LeBlond—Heavy. Motorized Gear Box Dr. Perfect Condition.

#1½ B&S PLAIN
#1½ CINCINNATI Plain
#1½ VAN NORMAN
#0 VAN NORMAN (2)
#12 B&S. Production Mill
#4 HENDEY Plain
#1A GOOLEY & EDLUND

PLANERS

42"x36"x12' CINCINNATI
20"x20"x24' N.B.P. Planer-Shaper

MISCELLANEOUS

#4 W-W Bulldozer
Riveting High Speed Hammers in all sizes.
Paper Cutter 42" ACME
Motors and Generators

MACHINISTS BENCH VISES

All Sizes—Plain and Swivel

SHAPERS

14" GOULD & EBERHARDT
15" POTTER & JOHNSTON
16" SMITH & MILLS
16" STOCKBRIDGE
17" SMITH & MILLS
20" OHIO
20" AMERICAN
20" CINCINNATI
24" GOULD & EBERHARDT, cone
24" GOULD & EBERHARDT, Gear Box
28" GOULD & EBERHARDT "Invincible"
24" Stockbridge
25" CINCINNATI

GRINDERS

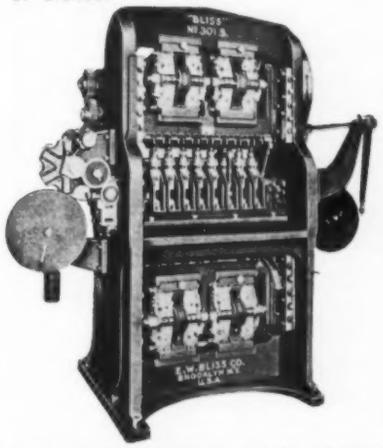
40" COVEL HANSHETT Rotary Surface Grinder, M.D.
#1 DIAMOND Surface Grinder, 12"x24" M.D.

THREAD MILLER

6x14 PRATT & WHITNEY

PRESSES

#18" BLISS, OBI
#19 BLISS, OBI, 3
#19C BLISS, OBI
#20 BLISS, OBI
#22B BLISS OBI
#21 BLISS, OBI
#21½ BLISS Grd. OBI
#75 TOLEDO Plain
#75 TOLEDO Geared
#3 CONSOLIDATED
#14 STOLL
#3 AMERICAN CAN CO. OBI
#3 ADRIANCE
#37½ BLISS S.S. Plain
#5 AMERICAN, S.S. Tie Rd
#3R MARQUETTE Grd: M.D.
#702 BLISS Flat Trimming
#4 BLISS, Back Flywheel
#50 PERKINS Dble Crank Pl.
#4 BAXENDALE (3) OBI
#6 WATERBURY O.B.I.
#25 STOLL Horn Press
#301S BLISS Auto. Gang Press
25-ton HENRY & WRIGHT
#93D TOLEDO S.S. Solid Frame, Dble crank; 4" stroke, grd
#166 CONSOLIDATED Dbl Cr., Geared, Air Cushions
2A W & S
2¼ x 24 J & L
3 x 36 J & L
24" GISHOLT



"BLISS" AUTOMATIC GANG PRESS, No. 301-S Code Work, exclusive of Dies and Sub-Presses, SYNOS

The machine illustrated above is particularly adapted for rapidly and economically producing from ribbon stock small sheet-steel or sheet-brass articles, the dimensions of which must be accurate and the manufacture of which requires a series of operations and considerable power. The press does eight operations simultaneously. It turns out 180 finished blanks a minute, requiring a total of 1440 operations.

Every Item Guaranteed—Write or wire Today

FALK MACHINERY CO.,
Machinery Merchants
18 WARD STREET, ROCHESTER, N.Y.

Partial List Only
Send Us Your Inquiries

...IN STOCK

AUTOMATICS
- No. 0 Brown & Sharpe
- ¾" Model F Gridley, four spindle
- 1¼" Model F Gridley, four spindle
- 1¾" Model F Gridley, four spindle
- 2¼" Model F Gridley, four spindle

BROACHES
- No. 3 LaPointe

DRILLS
- 3' Cincinnati Bickford radial
- No. 2 Colburn, single spindle
- 24" Barnes, power feed
- No. 12 Natco Multiple Spindle
- No. 13 Natco Multiple Spindle
- Three Way Natco Horizontal Multiple Spindle

GEAR CUTTERS
- No. 10 Lees-Bradner Gear Grinder
- 15" Gleason Spiral Bevel Generator
- 18" Gleason Gear Tester

GRINDERS
- No. 2 Cincinnati Centerless
- No. 70 Heald Internal
- No. 55 Heald Internal
- No. 60 Heald Internal
- 22"x84" Pratt & Whitney Surface
- No. 2 Brown & Sharpe Universal
- 10"x20" Landis Cylindrical
- 16x50 Norton Crankshaft
- 18"x96" Brown & Sharpe Cylindrical
- No. 200 Heald Rotary Surface
- 20A Bellvue Drill
- Ingersoll Cutter, Tub Type

LATHES
- 14"x6' Monarch, c.d.
- 16"x6' Lodge & Shipley, c.d.
- 16"x8' American, q.h.
- 18"x8' Monarch, c.d.
- 21"x8' LeBlond, c.d.
- 18/36"x12' Rahn Larmon Extension Bed Gap
- No. 9 LeBlond Multicut
- 9" Sundstrand Manufacturing
- 3½"x60" Fitchburg Lo-Swing, q.h.
- 8"x60" Fitchburg Lo-Swing, q.h.
- 11"x5' LeBlond Production, q.h.
- 14"x6' LeBlond Production, c.d.
- 18"x7' Chard Production, c.d.

TURRET LATHES
- No. 1B Foster
- Model C 26" Libby 7½" hole
- No. 2A Warner & Swasey
- No. 1 Warner & Swasey
- No. 4 Warner & Swasey
- No. 7 Bardons & Oliver
- No. 9 Bardons & Oliver
- 2¼x24 Jones & Lamson
- No. 6A Potter & Johnson Automatic

MILLS, BORING
- 52" Gisholt vertical, m.d., power rapid traverse

MILLS, PLAIN
- No. 3B Kearney & Trecker, s.p.d.
- No. 3 Cincinnati, c.d.
- No. 14A Garvin, c.d.
- No. 1 Bristol Hand

MILLS, UNIVERSAL
- No. 2 Cincinnati, s.p.d.
- No. 2A Garvin, c.d.

MILLS, VERTICAL
- No. AB Becker, c.d.
- No. 4B Becker, c.d.

PLANERS
- 30"x30"x8' Cincinnati
- 33"x33"x10' Cincinnati
- 36"x36"x12' Wodward & Powell

SAWS
- No. 4 Atkins Band, m.d.
- No. 12 Higley Cold Cut
- No. 6 Nutter & Barnes

SHAPERS
- 16" Hamilton, c.d.
- 20" Cincinnati, c.d.
- 24" Cincinnati, c.d.
- 24" Cincinnati, s.p.d.
- 28" American, s.p.d.

INDIANAPOLIS MACHINERY & SUPPLY CO., INC.
1959-69 South Meridian Street
INDIANAPOLIS, INDIANA
Eastern Branch:
44 WHITEHALL STREET, NEW YORK, N. Y.

EASTERN OFFERS

PIPE MACHINES
- 2" Landis Double Head Pipe & Nipple, cone
- Red-E-Haul Portable, m.d., 2"
- 2" Bignall & Keeler, m.d.
- 2" No. 70 Jarecki, m.d.
- 2" Merrell, m.d.
- 4" Bignall & Keeler, m.d.
- 4" Eaton, Cole & Burnham, cone
- 8" Bignall & Keeler, cone
- 8" Landis, m.d.
- 12" Landis, m.d. (2 in stock)

PLANERS
- 24"x24"x25' Gray, belt, 1 head
- 24"x24"x12' Chandler, 2 heads, belt
- 36"x36"x10' Cincinnati, 3 heads, belt
- 36"x36"x10' Whitcomb-Blaisdell, 2 heads, belt
- 36"x36"x13' Niles-Bement-Pond, 1 rail, 1 side head, belt
- 42"x42"x12' Niles-Bement-Pond, 2 heads, m.d., box table
- 42"x42"x18' Cincinnati, 2 heads, m.d.

PRESSES
- McDonald Single Crank, 4" stroke
- Waterbury-Farrel S.C. O.B. 1¾" stroke, weight 600 lbs.
- Waterbury-Farrel D.C. O.B. 1½" stroke, wt. 1700 lbs.
- No. 28 Consolidated O.B.I.
- C2 Ferracute O.B.I.
- D2 Ferracute Single Action Drawing
- DD2 Ferracute Double Action Drawing
- P2 Ferracute Stiles Type
- No. 6 Waterbury-Farrel D.C.
- S51 Ferracute D.C.
- DG53 Ferracute Redrawing
- No. 268¾B Toledo D.C. Toggle Drawing, 29" stroke, weight 175,000 lbs.
- No. 496D Toledo D.C. Toggle Drawing, 17" stroke, weight 160,000 lbs.
- 30 ton Lourie Hydraulic
- B33 Metalwood Hydro Pneumatic
- No. 0 Springfield Straightening

PUNCHES & SHEARS
- Buffalo Armor Plate Slitting size 10IWx20
- Cleveland Model EF S.E.
- No. 6 Long & Allstatter D.E.
- No. 6 Long & Allstatter S.E.

RIVETERS
- No. 2A, 2A H.D., 3A High Speed Hammer Co.
- ¼" Shuster
- Hanna Air Riveter, 13" throat
- Chicago Pneumatic 10x25x97
- Hanna Bench Type Air, 8" throat

CONE HEAD ENGINE LATHES
- 11"x5' South Bend
- 13"x6' Willard
- 14"x6' American
- 14"x6' Bradford
- 15"x6' Willard
- 16"x6' Bradford
- 16"x6' Pratt & Whitney
- 16"x8' Bradford
- 16"x8' Greaves-Klusman
- 16"x10' Bradford
- 16"x6' Bradford
- 18"x8' Bradford
- 18"x8' Lodge & Shipley
- 18"x8' Muller, taper
- 18"x10' Bradford
- 18" raised to 28"x10' Reed
- 18"x10' Springfield
- 18"x12' Barker
- 18"x12' Monarch
- 18"x12' Schumacher-Boye
- 18"x14' LeBlond, taper
- 19"x8' LeBlond, taper
- 19"x12' LeBlond, taper
- 20"x10' Davis
- 20"x10' Lodge & Shipley
- 20"x10' Pond
- 21"x8' LeBlond, taper
- 21"x10' LeBlond, taper
- 21"x12' Bradford
- 21"x16' LeBlond, taper
- 22"x12' Greaves-Klusman
- 22"x13' Niles
- 22"x18' Niles, taper
- 24"x10' Bridgeford
- 24"x10' Canada
- 24"x10' LeBlond
- 24"x10' Whitcomb-Blaisdell, taper
- 24"x11' Chard
- 24-48"x16' McCabe 2 in 1
- 24"x16' Schumacher-Boye
- 26"x18' Schumacher-Boye, taper
- 30"x14' Hamilton, taper
- 30"x16' Schumacher-Boye
- 30"x20' Schumacher-Boye, taper

Partial listing only. Send us your inquiries.

The EASTERN MACHINERY CO.
1004 TENNESSEE AVE.
CINCINNATI, OHIO

MISCELLANEOUS MACHINES

#3 Barrett 6" bar Cylinder Boring Machine
Rockford Dbl. End Hydraulic Boring Machine
24"x14' bed Schumacher-Boye Lathe, rebuilt
2" Landis Dbl. Spdl. Bolt Cutter
3" Landis Single Spdl. Bolt Cutter
36"x30x20' Whitcomb Planer, 2 heads
30x30x8' Gray Planer, 2 hds.
#40 NATCO Straight Line Multiple Drill
#60 NATCO 3-way Multiple Drill
#304A Oster 4" cap. Pipe Machine
Rockford Sgl. End. Hydraulic Boring Unit, with 2-sta. 54" dia. table
C-13H NATCO Hydraulic, m.d.
No. 14 NATCO Multiple with 12 spdls.

THE STRONG, CARLISLE & HAMMOND CO.
1392 West 3rd St., Cleveland, Ohio — 2832 E. Grand Blvd., Detroit, Mich.

ST. LOUIS' Headquarters FOR GOOD USED TOOLS, OFFERS:

GOULD & EBERHARDT 24", S.P. Shaper
BULLARD 51" Vert. Boring Mill
MUELLER 4½' Gear Box Drive Radial Drill
AMERICAN 34"x18' Q.C.G. M.D. Lathe
BARNES 4-S.P. Grd. Camel Back Drill
HENDEY 16"x10' Q.C.G. Grd. Hd. Lathe
CINCINNATI # 1-M S.P.D. Pl. Miller
NEWTON Vert. Miller 47" Rot. Table
INGERSOLL M.D. Slab Miller
B&S 48"x10" #4 Gear Cutter
LIBBY 24" Grd. H.D. Turret Lathe

Write Us For Any Other Tools You May Want
Let Us Quote On All Machinery Needs

McDONALD MACHINERY CO.
1531-35 N. Broadway — St. Louis, Mo.

IN STOCK — FOR SHIPMENT

30 Milling Machines

Shapers — Lathes
Drill Presses — Planers
Hack Saws — Surface Grinders
Arbor Presses—all sizes
Universal & Cutter Grinders

All our own rebuilding—fully guaranteed

J. NUTTALL
Established 52 years—same family
1748 N. 5th St. Philadelphia, Pa.
ORGANIZED TO HANDLE EXPORT ORDERS

30" X 20' LATHE

30" x 20' LeBlond Engine Lathe, motorized with motor, quick change feeds, excellent condition

THE O'BRIEN MACHINERY CO.
113 N. THIRD ST., PHILA., PA.

ATTENTION—SHIPYARDS

BORING BAR, PORTABLE—3⅛"-4½" UNDERWOOD Cylinder Reboring Machine, with 4 bars (4½" x 12', 4⅛" x 9', 3½" x 8', 3⅛" x 6'), complete with cutter heads, guides, tools, etc. EXCELLENT CONDITION.

ALSO MANY OTHER TOOLS

ALEX ZEEVE & COMPANY
2269 Woolworth Building New York, N. Y.

UNIVERSAL MILLING MACHINE

1—No. 42 Oesterlein, complete Universal equipment, table 71" x 13½".

BENNETT-RAFKIN MACHINE TOOL CO., Inc.
30 Church Str. New York City

FOR SALE
1—14' Sellers Vert. Boring Mill.
1—12" x 96" Landis Grander. Self-Cont.
1—#3 Ginn. High-Pwr. Vert. Miller
1—14" Pratt & Whitney Surf. Grinder
1—4" Bar Landis Floor Borer, M.D.
#3A Heavy B & S Universal Miller.
3—#3 & 1 #4 B & S Univ. grind., 3MD. New 1940.
1—42" Colburn Vert. Boring Mill
1—36" x 20' Le Blond Lathe, Q.C.G.
T. R. WIGGLESWORTH & CO., MACHINERY
5122 St. Clair Avenue — Cleveland, Ohio

Our policy is to continue giving the best we have for our customers and to bend every effort for immediate delivery of War Defense machinery

AUTOMATICS

1" **Cleveland** Model J double end threading, pointing, turning or drilling.
2" **Cleveland** Model A.
Nos. 24, 33 & 34 New Britain chucking.
No. 6A Potter & Johnston.
14" **Fay** automatic.
No. 16 Gisholt Simplimatics.

AIR COMPRESSORS

136', 8"x8" **Chicago Pneumatic Tool Co.**, type NSB.
136', 8"x8" **Ingersoll-Rand**, type ER1.
355', 12"x10" **Ingersoll-Rand**, type ER1.
357', 12"x10" **Bury**, class HL.
550', **National** 3-cylinder vertical.
620', 14"x8¾"x10' **Sullivan**, class WJ3, angle compound, 2 stage, synchronous motor.
706', 17"x9¾"x12" **Sullivan**, class WJ3 angle.
868', 17"x10"x12" **Chicago Pneumatic Tool Co.**, type OCB, 2 stage.

BROACHES

No. 1 LaPointe, screw type.
No. 2 Standard screw type broaching press, 12" stroke.
No. 3 Oilgear hydraulic, motor drive.
Nos. 3 & 4 LaPointe of Hudson, screw type.
No. 3 J. N. LaPointe double screw type.
No. 3 American high speed, rack type.

DRILLS, RADIAL

3' **Cincinnati.**
4' **Hammond** sensitive, elbow arm, Tapper.
4' **American.**
3½', 5' & 7' **Western.**
6' **American**, 14" column.

GEAR MACHINERY

5A Cincinnati gear cutter.
No. 18H Gould & Eberhardt universal gear hobber.
12"x13" **No. 12H Gould & Eberhardt** Mfg. hobber.
12"x10" **No. 12 Barber Colman** hobbers.
24" **No. 3 Adams Farwell** gear hobber.
8"x10" **No. 1 Lees Bradner** production hobber.
14"x8" **No. 5A Lees Bradner** universal hobbers.
26"x8" **No. 3 Brown & Sharpe** auto. spur.
36"x6" **Gould & Eberhardt** spur gear cutter.
48"x10" **No. 4 Brown & Sharpe** automatic spur.
National Tool Co. (Cleveland) Model B gear and gear shaper cutter checking machine.
Lipe gear tooth chamfering machine, double spindle.

LATHES, ENGINE

All have quick change gears unless otherwise noted.
14"x6' **LeBlond.**
14"x 8' **Lodge & Shipley**, patent head.
14"x 8' & 16"x10' & 18"x8' **Monarch.**
16"x 6' **Cincinnati.**
16"x 8' **American.**
18"x 6' **Rahn Larmon.**
18"x 8' **Walcott.**
18"x 8' **American.**
19"x 8' **Sidney.**
20"x10' **American.**
20"x13' **Davis**, double back geared.
24"x10' **Schumacher & Boye**, D.B.G. & T.A.
24"x10' **LeBlond** heavy duty, D.B.G. & T.A.
24"x10½' **New Haven**, standard change gear.
24"x12' **Lodge & Shipley** patent head.
24"x14' **Schumacher Boye.**
24"x16' **Schumacher Boye**, D.B.G. & T.A.
36"-43"x18' **New Haven**, 23" bed extension.
36"-47½"x21'0" **Wickes** double back geared.

LATHES, TURRET

Most of these can be supplied either with bar feed and automatic chuck or arranged for chucking work.
No. 3A Warner & Swasey.
14" **Warner & Swasey.**
1½" (18" swing), **No. 3 Gisholt.**
1½" (17" swing), **No. 4 Foster**, power cross feed.
2¼"x26" **Acme.**
17½" swing **No. 4 Bardons & Oliver.**
18" swing **No. 4 Cincinnati Acme.**
21" **Gisholt.**
2¼"x24" **Jones & Lamson**, cross feeding headstock.
3"x36" (14½" swing) **Jones & Lamson**, cross feeding headstock.
24" **Steinle**, geared head.

LATHES, PRODUCTION

9"x14" **Porter** cable.
9"x24" **Sundstrand.**
13"x 4' **LeBlond** geared head.
13"x 6' **Automatic** threading lathes, geared head.
16"x 5' **Monarch** Mfg. or rapid production.
16"x10' **LeBlond** rapid production.
18"x 7'-6" **Wickes** geared head, rapid production.
20"x8' **Wickes** 12 speed selective geared head Rapid Prod.
34"x61½" **between spindles Wickes** semi-automatic center drive crankshaft.
Melling 4 cylinder camshaft lathe.
Melling 6 cylinder crankshaft lathe.

MILLS, VERTICAL BORING

34" **Colburn.**
36" **Niles** car wheel boring.
60" **Bullard**, 2 swivel heads, power rapid traverse, motor drive.
62" **Colburn**, 2 swivel heads, motor drive, power rapid traverse.

MILLING MACHINES

No. 2A Owen, universal.
No. 14A Garvin, plain. Range 28"x8"x19".
No. 34 Ohio (Oesterlein) plain. Range 34"x12"x19".
No. 3 Van Norman duplex.

MILLING MACHINES, VERTICAL

No. 6 Becker, 18"x61" table.
Model A B Becker, 10¾"x32¾" table.
No. 3 Becker, 10¼"x28" table.
Model C Becker, 29¾" rotary table.
Nos. 1 & 1½ Knight.
No. 5 Brown & Sharpe, 16"x52" table. Range 52"x12"x24". Has 20" dia. power feed rotary table.

MILLERS, PRODUCTION AND MISCELLANEOUS

Sundstrand Rigidmill with rotary table.
12" **Cincinnati** plain and BG Mfg. millers.
48" **Newton**, 2 spindle continuous rotary.
60" **Ingersoll**, 3 spindle, continuous rotary.
No. 45 Bilton Productomatic.
Nos. 3, 3B & 6 Lees Bradner thread miller.
No. 3½ Fox, hand.
No. 33 Kempsmith Mfg.
Nos. 1 & 1A Davis & Thompson drum type continuous.

PLANERS

24"x24"x24" **Cincinnati**, crank type, one rail head.
24"x24"x 5' & 0' **Gray**, 1 rail head.
24"x24"x 6' **Woodward & Powell**, 1 rail head.
26"x26"x 8' **American**, 1 rail head.
30"x30"x10' **Cincinnati**, one (or two) rail heads.
32"x32"x12' **Niles**, 1 rail & 1 side head.
36"x36"x10' **Woodward & Powell.**
56"x56"x16' **Gray**, 2 rail and 2 side heads.

SHAPERS

7" **Rhodes.**
15" **American.**
16" **Walcott.**
20" **Smith & Mills.**
22" **Ohio.**
24" **Gould & Eberhardt.**
24" **Cincinnati.**
24" **Rockford.**
24"x24"x24" **Cincinnati** crank shaper planer.
32" & 36" **Morton** draw cut.

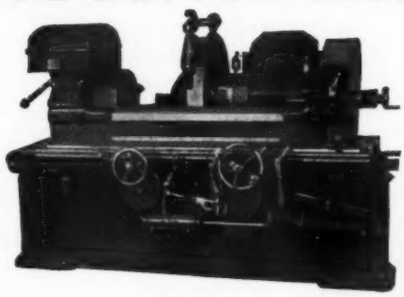
SHEET METAL AND WIRE MACHINERY

4'x3/16" **Cincinnati** press brake.
72"x14 ga. **Stamco** squaring, motor drive.
No. 1A Ajax taper forging roll.
Yoder fender roll.
⅜"x3' & 5' **Shuster** wire straightener and cutters.

Ask for complete List No. 173

MILES MACHINERY COMPANY - - - - Saginaw, Mich.

HILL-CLARKE MOTOR DRIVEN GRINDERS



SIZES

6 x 32	10 x 72	16 x 36
10 x 18	14 x 36	16" x 50"
10 x 24	14 x 50	16 x 72
10 x 36	14 x 72	18 x 96
10 x 50	14 x 96	

HILL-CLARKE MACHINERY CO.
651 WASHINGTON BLVD. CHICAGO

UNUSUAL VALUES

Shapers: 24" G&E, 16" Niles
28"x20'6" **Rahn-Carpenter Lathe** 14' between centers
24"x16' **Greaves & Klusman**
Briggs Type A Milling Machine, Long Table
#12 **Brown & Sharpe Production Milling Machine**
Presses: #43 Niagara, #16 J. M. Robinson ⅜" capacity Rock River punch and shear
Turret Lathe: #4 Bardons & Oliver
Drill Presses: 28", 24" Hoefer; 25", 20", 40" Bement
2 50# **Bradley upright hammers**, m.d. like new
Radial Drills: 5' Bausch
Miller: 20"x24"x18" Ingersoll
Grinders: #20 Bryant Internal
300 other machinery items
MOTORS—new 5 H.P. for 3-phase, ball brg. $55.75

Other sizes equally low priced. Also rebuilt motors.

THE OSBORNE & SEXTON MACHINERY CO.
COLUMBUS, OHIO

GEAR CUTTERS, Spur, 30", 40" & 84", M.D.
GEAR PLANERS, Bevel, 36" & 54" Gleason, M.D.
GRINDER, Gear Tooth D-12 Detroit, M.D.
GRINDER, Warm Hob 10" x 12", B.D.
GRINDER, Universal, No. 5 B & S, 20"x72", B.D.
LATHES, Geared Head, 15"x8', 20"x10', 24"x12'
MILLER, Plain No. 14 Garvin, B.D.

LANG MACHINERY COMPANY
28th Street & A.V.R.R. Pittsburgh, Pa.

EMERMAN RED BOOK
HEADQUARTERS FOR ALL TYPES OF USED METAL WORKING MACHINERY— STAMPING PRESSES—STRUCTURAL TOOLS
LOUIS E. EMERMAN AND COMPANY
1761 ELSTON AVE. CHICAGO TEL. BRUNSWICK 4130
—Also FORGING EQUIPMENT—HYDRAULIC EQUIPMENT
—Our Stock is Large and Varied
—Our Prices Represent Real Values
SEND US YOUR INQUIRIES

Defense Savings Pay-Roll Allotment Plan

How company heads can help their country, their employees, and themselves

voluntary pay-roll allotment plan | helps workers provide for the future | helps build future buying power | helps defend America today

This is no charity plea. It is a sound business proposition that vitally concerns the present and future welfare of your company, your employees, and yourself.

During the post-war period of readjustment, you may be faced with the unpleasant necessity of turning employees out into a confused and cheerless world. But you, as an employer, can do something *now* to help shape the destinies of your people. Scores of business heads have adopted the Voluntary Pay-roll Allotment Plan as a simple and easy way for every worker in the land to start a *systematic* and *continuous* Defense Bond savings program.

Many benefits . . . present and future. It is more than a sensible step toward reducing the ranks of the post-war needy. It will help spread financial participation in National Defense among all of America's wage earners.

The widespread use of this plan will materially retard inflation. It will "store" part of our pyramiding national income that would otherwise be spent as fast as it's earned, increasing the demand for our diminishing supply of consumer goods.

And don't overlook the immediate benefit . . . money for defense materials, quickly, continuously, *willingly*.

Let's do it the American way! America's talent for working out emergency problems, democratically, is being tested today. As always, we will work it out, without pressure or coercion . . . in that old American way; each businessman strengthening his *own* house; not waiting for his neighbor to do it. That custom has, throughout history, enabled America to get things done *of its own free will*.

In emergencies, America doesn't do things "hit-or-miss." We would get there *eventually* if we just left it to everybody's whim to buy Defense Bonds when they thought of it. But we're a nation of businessmen who understand that the way to get a thing done is to *systematize* the operation. That is why so many employers are getting back of this Voluntary Savings Plan.

Like most efficient systems, it is amazingly simple. All you have to do is offer your employees the convenience of having a fixed sum allotted, from each pay envelope, to the purchase of Defense Bonds. The employer holds these funds in a separate bank account, and delivers a Bond to the employee each time his allotments accumulate to a sufficient amount.

Each employee who chooses to start this savings plan decides for himself the denomination of the Bonds to be purchased and the amount to be allotted from his wages each pay day.

How big does a company have to be? From three employees on up. Size has nothing to do with it. It works equally well in stores, schools, publishing houses, factories, or banks. This whole idea of pay-roll allotment has been evolved by businessmen in cooperation with the Treasury Department. Each organization adopts its own simple, efficient application of the idea in accordance with the needs of its own set-up

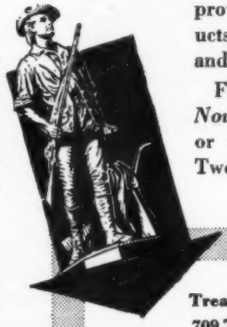
No chore at all. The system is so simple that A. T. & T. uses exactly the same easy card system that is being used by hundreds of companies having fewer than 25 employees! It is simple enough to be handled by a check-mark on a card each pay day.

Plenty of help available. Although this is *your* plan when you put it into effect, the Treasury Department is ready and willing to give you all kinds of help. Local civilian committees in 48 States are set up to have experienced men work with you just as much as you want them to, and no more.

Truly, about all *you* have to do is to indicate your willingness to get your organization started. We will supply most of the necessary material, and no end of help.

The first step is to take a closer look. Sending in the coupon in no way obligates you to install the Plan. It will simply give you a chance to scrutinize the available material and see what other companies are already doing. It will bring you samples of literature explaining the benefits to employees and describing the various denominations of Defense Savings Bonds that can be purchased through the Plan.

Sending the coupon does nothing more than signify that you are anxious to do *something* to help keep your people off relief when defense production sloughs off; *something* to enable *all* wage earners to participate in financing Defense; *something* to provide tomorrow's buying power for your products; *something* to get money *right now* for guns and tanks and planes and ships.



France left it to "hit-or-miss" . . . and *missed*. *Now* is the time for *you* to act! Mail the coupon or write Treasury Department, Section A, 709 Twelfth St. NW., Washington, D. C.

FREE - NO OBLIGATION

Treasury Department, Section A,
709 Twelfth St. NW., Washington, D. C.

Please send me the free kit of material being used by companies that have installed the Voluntary Defense Savings Pay-Roll Allotment Plan.

Name _____

Position _____

Company _____

Address _____

QUICK DELIVERY FROM STOCK!

FLOOR LATHES

30' Pit, 156" face plate
52"x22' Fifield
36"x28' Bridgeford, G.H., swing 62" with raising blocks
36"x16' Schumacher & Boye
36"x36' & 36"x22' New Haven
36"x16' & 32"x16' Bridgeford
30"x18' Lodge & Shipley
27"x16' & 26"x9' Bridgeford
20"x20' Monarch
20"x12' Wolcott
22"x16' Hamilton
18"x8' Monarch
22"x12' L&S, G.H.
18"x10' L&S
18"x10' American
18"x7', 16"x6' Hendey Yoke Head
14"x6' Bradford, G.H.
14"x8' Hendey, G.H.
15"x8' Sebastian, G.H.

LARGE PRESSES

No. 97-H TOLEDO Dble. Crank Press
10" str.; Dble. Gd., Tie rod constr., Max. pressure approx. 600 tons; Est. wgt. 245,000 lbs.

Clearing Crankless 4 Point Suspension Type, Triple Action Press
All steel constr., Gears enclosed running in oil; Bed 84"x133"; Cap, blankholder & plunger slide 1350 tons; M.D., Weight approx. 518,000 lbs.

No. 409 Bliss D.C. Toggle Press
108" bet. housings; Tie rod; Air cushions

TURRET LATHES

Nos. 2A, 3A, & 6 W&S
24" Gisholt Universal
28" Pond (2) 24" Steinles
(2) 22" Libbeys

MILLS

PLAIN: Nos. 2 & 3 Cincinnati
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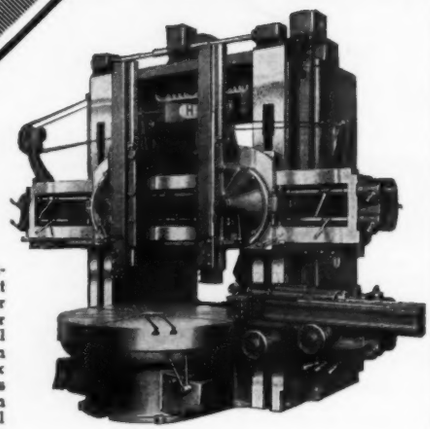

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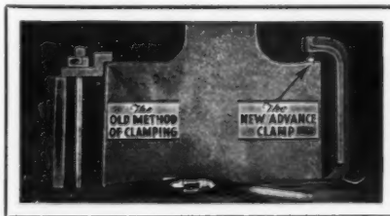

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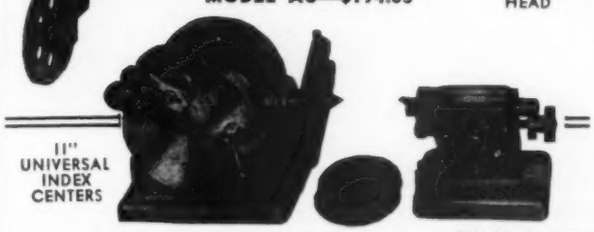

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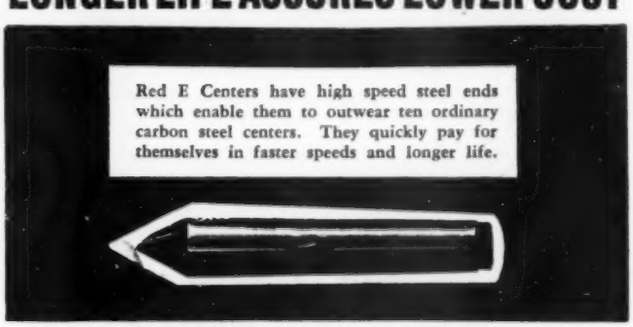
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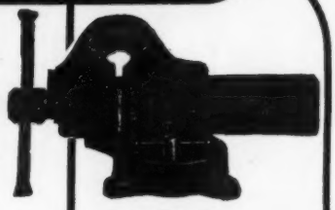

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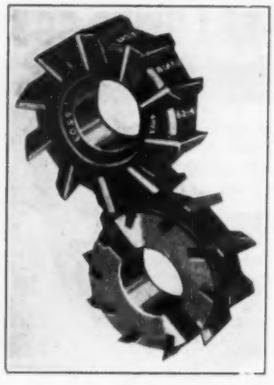

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Carboloy Co., Detroit, Mich.
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Excello Corp., Detroit, Mich.
Kearney & Trecker Corp., Milwaukee, Wis.
Lovejoy Tool Co. Inc., Springfield, Vt.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Union Twist Drill Co., Athol, Mass.

CUTTERS, Pipe, Hand
Armstrong Bros. Tool Co., Chicago, Ill.

CUTTING, Abrasive
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Etna Machine Co., Toledo, Ohio.
Landis Mach. Co., Waynesboro, Pa.
Porter-McLeod Machine Tool Co., Hatfield, Mass.

CUTTING-OFF MACHINES, Abrasive
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Catskill Metal Works, Catskill, N. Y.
Porter-McLeod Machine Tool Co., Hatfield, Mass.

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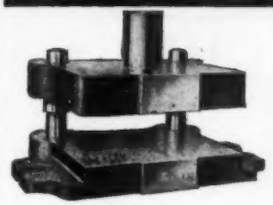

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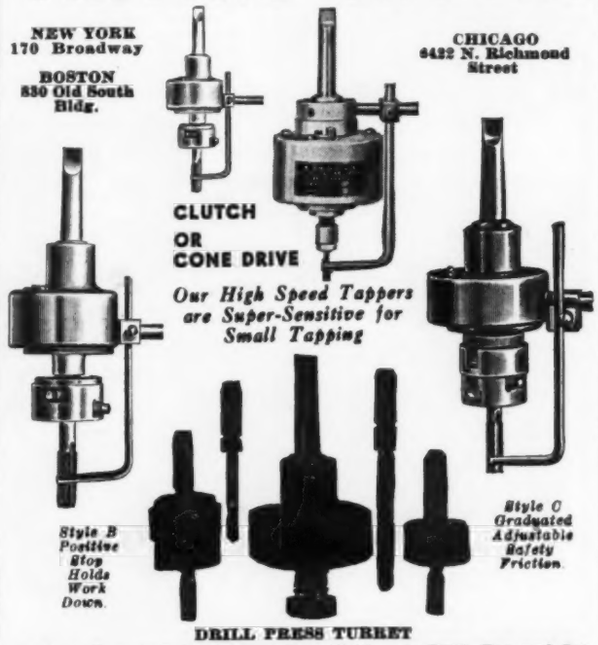
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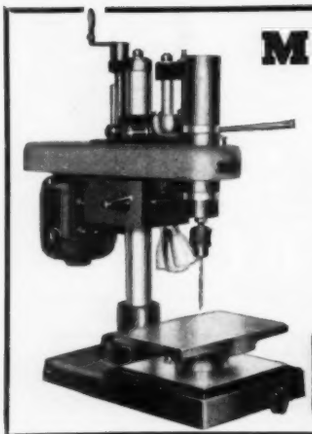

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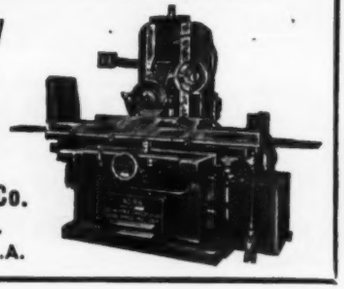

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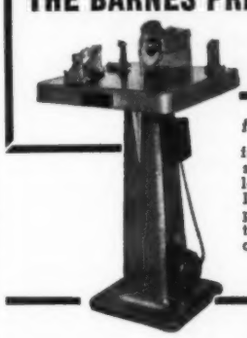

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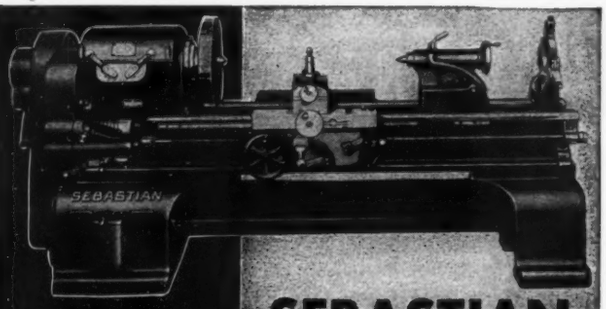

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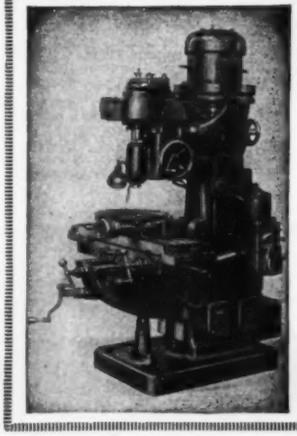

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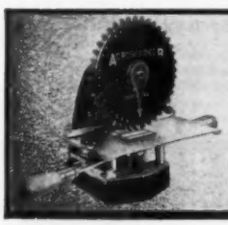

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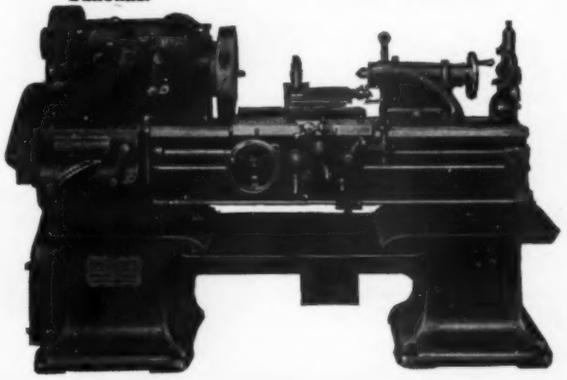

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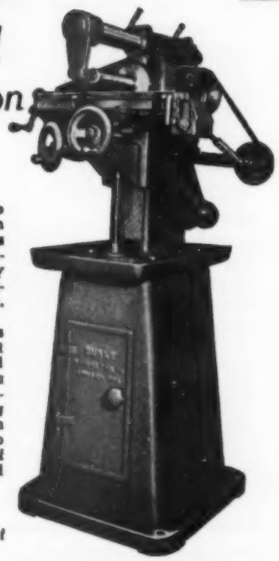

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No. 1
NEW
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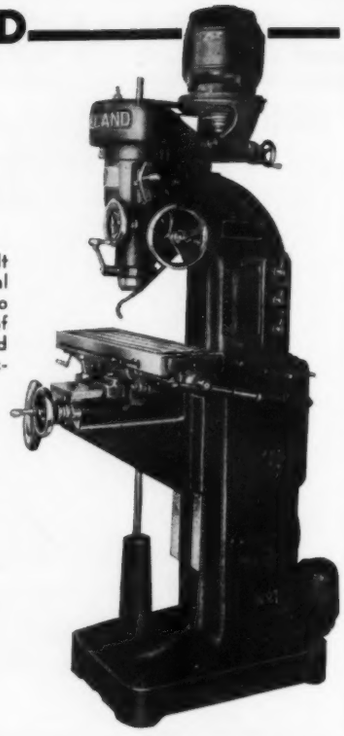

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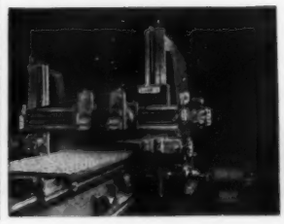

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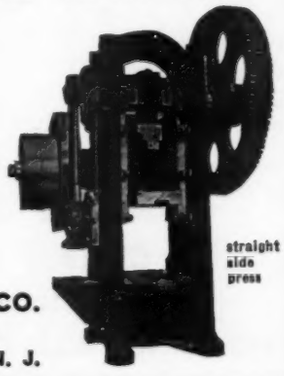
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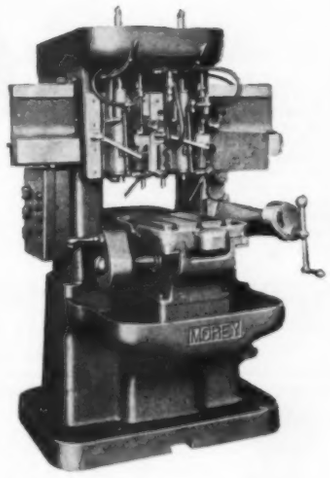

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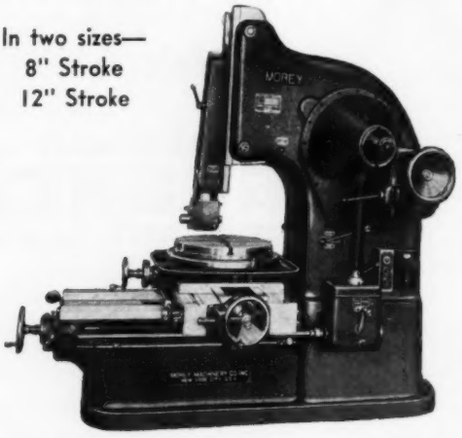

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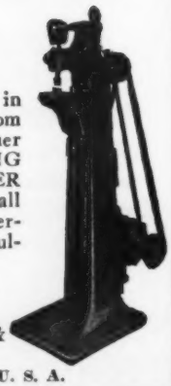

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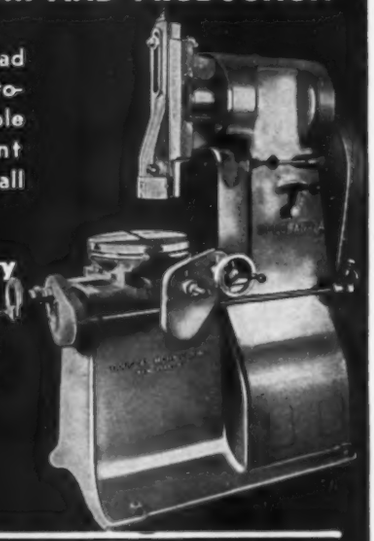

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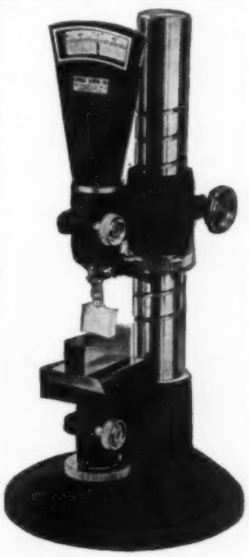

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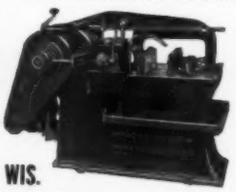

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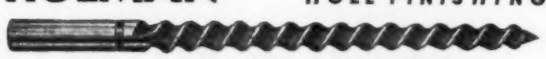

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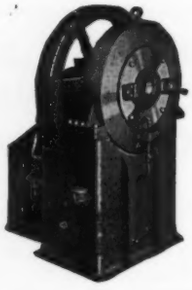

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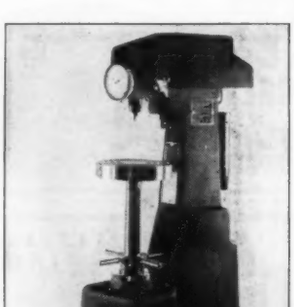
Dony Mchry. Co., D. E., Rochester, N. Y.
Dulien Steel Prod., Inc., Fresno, Calif.
Eastern Mchy. Co., Cincinnati, Ohio
Emerman & Co., Louis E., Chicago, Ill.



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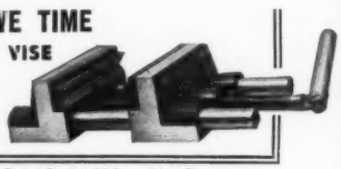

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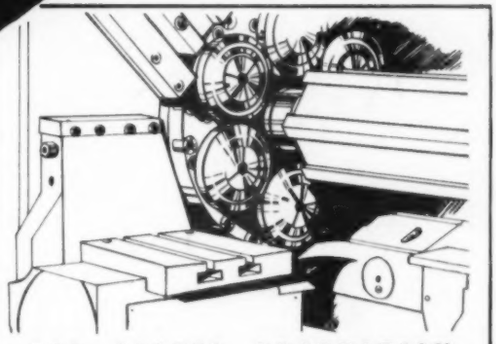

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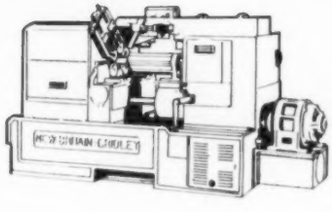

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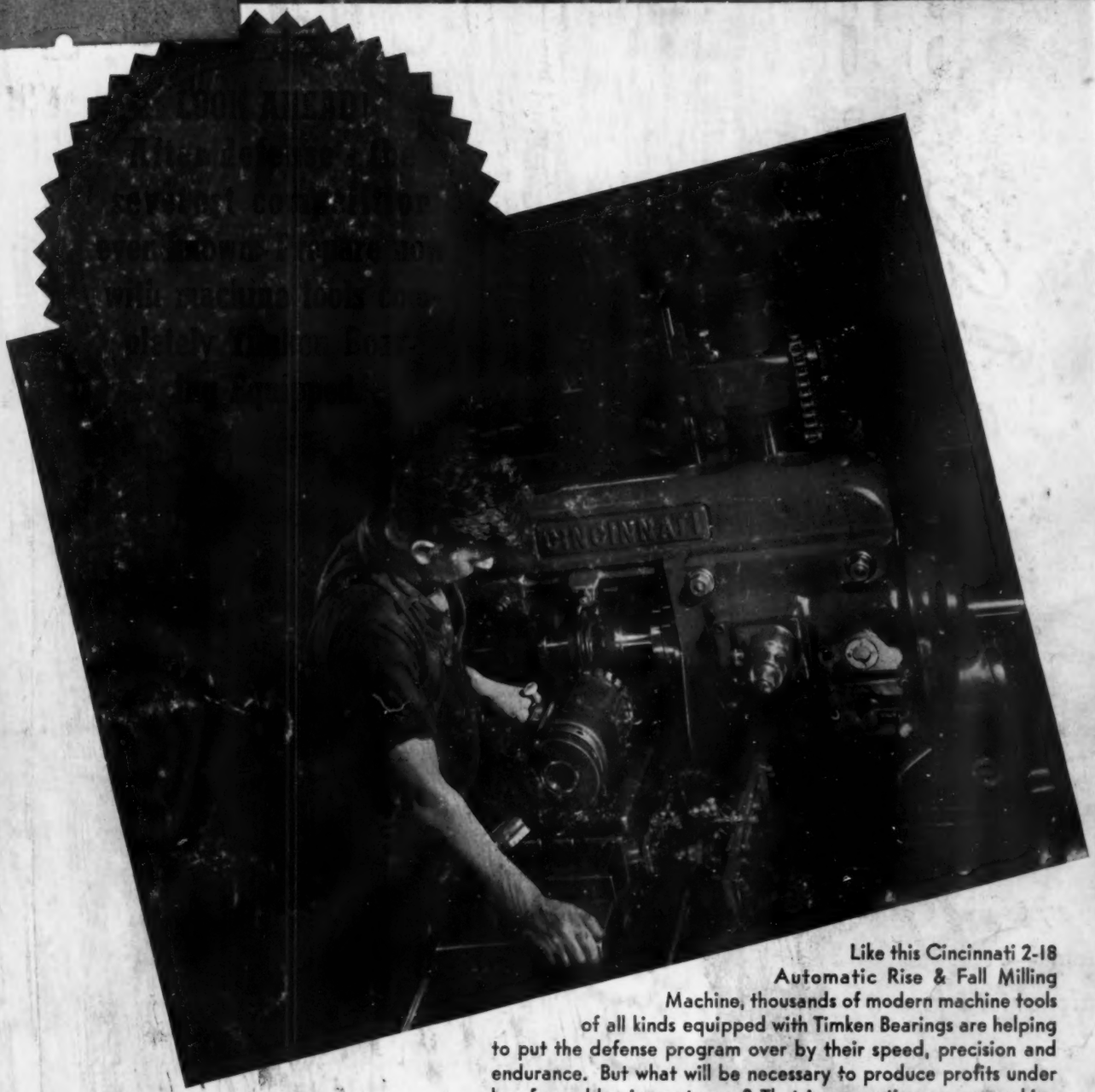

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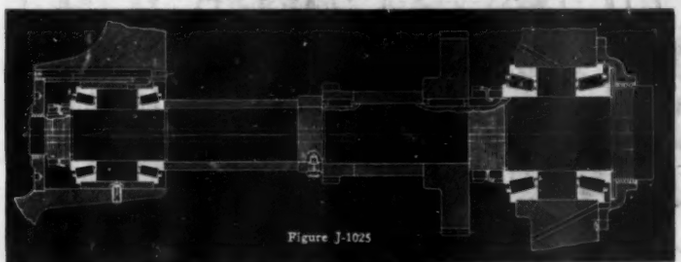

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